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Full Length Research Paper

Monitoring of enteric fever and diarrhea causing bacteria in a rural setting in Nigeria

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Blood and stool samples of patients attending the General Hospital Abudu, Edo State, Nigeria were analyzed to know the prevalence of enteric fever and diarrhea causing bacteria in the area in 2006, 2007 and 2008. Blood sample was collected in Robertson cooked medium and glucose broth; then subcultured on blood agar, macConkey agar,*salmonella/shigella* agar and nutrient agar. Widal agglutination test was also carried out on the blood samples. Stool sample was inoculated into thiosulfate bile sucrose medium, seleniteF medium and later subcultured on macConkey agar and salmonella/*shigella* agar. Of the patients screened, the percentage incidence of *Salmonella typhi* was between 17.5 and 56.5% in 2007; *Salmonella paratyphi* C was between 2.0 and 26.7%; *Salmonella paratyphi* A was between 0 and 9.4% and *Salmonella paratyphi* B was between 0 and 0.7%; enteropathogenic *Escherichia coli* was between 0 and 0.6%; neither *shigella* nor *Vibrio cholera* was isolated. In 2008 of the *salmonella* organisms, the incidence of *S. typhi* was highest with frequency of 19.7 to 54.5%, followed by *S. para*typhi C: 1.0 to 12.6%; *S. paratyphi* A: 0 to 3.9%, and enteropathogenic *E. coli* was 0 to 0.8%, and in 2009, the incidence or *Salmonella typhi* was highest with a frequency of 2.7 to 68.3%. There was no significant difference (p>o.05) between *S. typhi* incidence throughout the study period. However, there was a significant difference (p<.05) between the incidence of *S. typhi* and other isolates. This project revealed a high rate of typhoid fever (enteric fever) caused by *S. typhi* in Abudu (study area). Further work should be done to identify the source or sources of infection especially their water supply as typhoid fever is a water-borne disease.

Key words: Enteric fever, incidence, prevalence, subcultured, typhoid fever.

INTRODUCTION

Enteric fever and diarrhea are diseases caused by microorganisms of the genera *Salmonella, Shigella, Vibrio, Campylobacter, Yersinia* and *Escherichia*. In some communities, these diseases have become endemic especially where public health consideration is low. Incidence of these diseases can result in high mortality if not properly controlled. Typhoid fever, an enteric fever is characterized by headache, abdominal pain, fever (greater than 38°C) and general lethargy. The mode of transmission of typhoid fever is through drinking water contaminated with faecal matter (WHO, 2004). It is estimated that more than five million people die from diarrhoeal illnesses yearly. According to WHO (2009), in developing countries, it is predominantly children under the age of five years who suffer from diarrhea. Most people die due to pathogenic microorganisms, such as bacteria or viruses, which were ingested into the gastro-intestinal tract through contaminated drinking water or food. Determining which bacterium is causing the illness in those cases is sometimes very complex. Diarrhoeal illnesses can cause long-term damage to the development of a country; micro-economically due to financial pressures for medical assistance and the physical deterioration of individuals, and macro- economically

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Table 1. Percentage incidence of enteric fever and diarrhea causing bacteria in patients attending General Hospital, Abudu in 2006.

Month	Total no. of patient screened	*Salmonella paratyphi A*	*Salmonella paratyphi B*	*Salmonella paratyphi C*	*Salmonella typhi*	*Enteropathogenic Escherichia coli*	*Shigella* sp.	*Vibrio cholera*
Jan	300	1.0	-	5.0	20.0	-	-	-
Feb	225	1.3	-	9.8	42.2	-	-	-
March	106	-	-	6.6	53.8	-	-	-
April	85	9.4	-	16.5	56.5	-	-	-
May	285	1.8	-	2.8	17.5	-	-	-
June	223	1.8	0.7	7.2	31.4	-	-	-
July	235	0.9	-	2.6	33.2	-	-	-
Aug	150	2.7	-	8.0	43.3	-	-	-
Sept	227	0.4	-	2.0	26.0	0.6	-	-
Oct	195	0.5	0.4	7.7	46.0	-	-	-
Nov	60	0.7	-	16.7	47.0	-	-	-
Dec	30	-	-	26.7	36.7	-	-	-

due to absences from work and the corresponding consequences for the economy. Diarrhoeal illnesses can be prevented easily by expanding the water/waste water and public health systems, enhancing hygiene and sanitary measures. Abudu, a rural settlement in Edo state, Nigeria has a population of 11,271 (Nigerian National Commission, 1991). It is a local government headquarters and is situated in a valley. Inhabitants who are mainly peasant farmers make use of the river, River Orhionmwon and untreated borehole water as their sources of water supply for their domestic activities as well as for drinking. People leaving along the river bank defecate directly into the river as well as using it for bathing, washing and cooking (Ajayi and Osibanjo, 1981). The water table is high (at depth of 10 m an aquifer is struck). This makes the aquifer prone to pollution from septic soak-away pit (APHA, 1971). The main health institution here is the general hospital which has high patient attendance. Majority of cases treated here is typhoid fever.

Justification

Majority of patients attending the general hospital Abudu present with signs and symptoms of enteric fever such as headache, fever, abdominal pains, nausea. diarrhea and general lethargy. Knowing the causative agents of this condition and monitoring the pattern of distribution of these organisms will help in achieving proper treatment for these patients.

MATERIALS AND METHODS

All media except *Salmonella/shigella* agar and selenite F, and glass wares were sterilized by using an autoclave at 121°C for 15 min. They were however constituted and boiled according to manufacturer's specification. Sterilized nutrient agar was cooled to 42°C before adding human blood and allowed to set to form blood agar (Cheesbrough, 2000). Loop wire was sterilized by flaming using the Bunsen burner.

Stool sample

Stool sample was inoculated into Selenite F broth for enrichment, incubated at 37°C for 24 h. This was later subcultured onto salmonella/shigella agar and incubated at 37°C for 24 h.

Blood sample

Two milliliter of blood sample was collected into Robertson cooked meat medium and glucose broth and then incubated at 37°C for 24 h. Subculturing was done on blood agar, macconkey agar, *salmonella/shigella* agar and nutrient agar (Ogbulie et al., 1988).

Widal agglutination test was carried out on sera using commercial stained antigens. They were for *Salmonella paratyphi* A, *Salmonella parptyphi* B, *Salmonella paratyphi* C and *Salmonella typhi*.

Identification of bacterial isolates

Bacterial isolates were identified using cultural characteristics and biochemical reactions as recommended by Baker and Breach (1980).

Typing of isolates

Commercial sera were used to type isolates using tile method (Cruickshank, 1976).

RESULTS

In Table 1, three hundred patients were screened in January 2006. Of this number, the percentage incidence of S*almonella* A, *S. paratyphi* B, *S. paratyphi* C and *S. typhi* were 1, 0, 5 and 20%, respectively. No *Escherichia*

Table 2. Percentage incidence of enteric fever and diarrhoea causing bacteria in patients attending General Hospital, Abudu in 2007.

Month	Total no. of patient screened	*S. paratyphi A*	*S. paratyphi B*	*S. paratyphi C*	*S. typhi*	Enteropathogenic *E. coli*	*Shigella* sp.	*V. cholera*
Jan	304	0.7	-	1.3	25.7	-	-	-
Feb	247	0.8	-	1.2	36.0	0.8	-	-
March	206	2.9	-	12.6	36.4	-	-	-
April	198	1.5	1.0	3.5	54.5	-	-	-
May	200	1.5	-	2.5	30.0	-	-	-
June	301	0.3	-	1.0	27.2	-	-	-
July	284	0.4	-	2.5	19.7	-	-	-
Aug	198	-	-	1.5	39.4	-	-	-
Sept	209	0.5	-	8.0	30.0	0.6	-	-
Oct	156	1.3	-	3.8	53.2	-	-	-
Nov	108	1.9	0.9	3.7	50.9	-	-	-
Dec	51	3.9	-	2.9	39.2	-	-	-

Table 3. Percentange incidence of enteric fever and diarrhoea causing bacteria in patients attending General Hospital, Abudu in 2008.

Month	Total no of patient screened	*S.] paratyphi A*	*S. paratyphi B*	*S. paratyphi C*	*S. typhi*	Enteropathogenic *E. coli*	*Shigella* sp.	*V. cholera*
Jan	198	-	-	3.1	38.5	-	-	-
Feb	188	1.1	-	3.7	2.7	-	-	-
March	253	0.8	0.4	3.2	39.7	-	-	-
April	175	1.7	-	4.0	40.0	-	-	-
May	203	1.0	0.5	4.4	26.6	-	-	-
June	310	-	-	1.0	31.3	-	-	-
July	277	-	-	0.7	32.0	-	-	-
Aug	185	3.2	-	2.2	34.6	-	-	-
Sept	197	0.5	-	4.1	30.5	1.0	-	-
Oct	120	0.8	0.8	5.0	68.3	-	-	-
Nov	90	1.1	-	3.3	62.2	-	-	-
Dec	37	2.7	-	2.7	27.0	-		-

coli, Shigella spp. and *V. cholera* were isolated. In April 2006, the highest incidence of 56.5% was recorded for *S. typhi*. *S. paratyphi* C and *S. typhi* were isolated throughout the year while *Shigella* spp. and *V. cholera* were not isolated during this period (Table 1). Also in Table 1, total number of patients screened (the lowest) in December while the highest number of patients screened was 300 in January. In 2007 (Table 2), the pattern of distribution of isolates were similar. For example, *S. paratyphi* C and were isolated throughout the year. Highest number of patients screened was in January while the lowest was in December.

However, in Table 3 the highest number of patients screened was 310 in June while the lowest was 37 in December. *S. paratyphi* C and *S. typhi* were isolated throughout the year. *S. typhi* had the highest incidence which peaked at 68.3% in October. Neither *Shigella* nor *V. cholera* was isolated.

Percentage incidence of *S. typhi* was 17.5 to 56.5%, 19.7 to 54.5% and 2.7 to 68.3% in 2006, 2007 and 2008, respectively. Incidence of *S. paratyphi* C was 2 to 26.7%, 1 to 12.6% and 0.7 to 5% in 2006, 2007, and 2008, respectively.

Patients attending General Hospital, Abudu

Blood and stool samples of patients attending General Hospital, Abudu were screened for enteric bacteria on monthly basis from January 2006 to December 2008. *S. typhi* had the highest incidence followed by *S. paratyphi* C throughout the study period. Incidence of *S. paratyphi A* and B were low. Neither *Shigella* spp. nor *V. cholera* was isolated. Enteropathogenic *E. coli* were virtually absent; where they occurred, incidence was very low.

DISCUSSION

From the results, *S. paratyphi* C and *S. typhi* were isolated throughout the study. These organisms are the

major causes of paratyphoid and typhoid fever in Nigeria. Their constant isolation in this study area implies that there is active pollution of their sources of water supply with faecal matter containing these organisms among other microorganisms. There was no significant difference ($p<0.05$) between *S. typhi* incidence throughout the three years study period. *S. typhi* had the highest incidence as an indication that typhoid fever caused by this organism is the most common. The low patient turn out especially in December is due to the festivities (Christmas/New year celebrations). Many inhabitants travel from the study area (Abudu) to cities to celebrate Christmas thereby depleting the population here. Another reason for low patient turnout is that people save to make merriment at this time that they managed their health at home to reduce cost of going to the hospital. However, in January, patient's turnout was very high due to the effect of heavy festivities; the previous month (December) when eating wining and drinking possibly contaminated water was much. There was a significant difference ($p<0.05$) between the incidence of *S. typhi* and other isolates throughout the study period. This is due to the high incidence of typhoid fever when compared to other enteric fever in this locality.

CONCLUSION AND RECOMMENDATION

The high incidence of typhoid and paratyphoid fever in Abudu has been revealed within the study period. This finding is alarming as tracing the source or sources of these infections becomes urgent and inevitable. More research work is recommended to trace carriers. Meanwhile water for drinking in Abudu should be boiled before drinking (APHA, 1971).

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