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Prevalence of shigellosis diarrhoea in a paediatrics population: hospital based survey in Bangui, Central African Republic

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Abstract

Introduction: Shigellosis is still a major public health problem in sub-Saharan countries, especially among children.

Methodology: The prevalence of shigellosis in children presenting with diarrhoea in the *Complexe Pédiatrique* de Bangui, Central African Republic, was determined. Stools were analyzed in the bacteriology laboratory of the Institut Pasteur de Bangui, Central African Republic, where identification of *Shigella* species and analysis of antibiotics susceptibility were performed.

Results: A total of 15 strains of *Shigella* were isolated from 156 stools; *Shigella flexneri* was the only species found. Two infected children died of dehydration. Most strains were resistant to antibiotics except quinolones, which were active on all of these strains.

Conclusions: The control of *Shigella* infections should be reinforced in Bangui, and accurate, affordable and rapid methods of diagnosis would be helpful.

Key words: shigellosis; paediatrics; Central Africa

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Introduction

Diarrhoea is a major cause of mortality and morbidity in developing countries [1]. Shigellosis is a significant cause, especially in children under five years old [2]. *Shigella flexneri* is the leading cause of shigellosis, particularly in the poor populations [3]. Shigellosis is endemic in Central African Republic (CAR), where an outbreak of *Shigella dysenteriae type 1* was recently reported [4]. The present study was undertaken to determine the prevalence and the antimicrobial susceptibility patterns of *Shigella* serotypes in children hospitalized for diarrhoea in a paediatric unit in Bangui, CAR.

Methodology

Study population

This study was undertaken to evaluate the prevalence of in diarrhoeic stools at the *Complexe Pédiatrique* of Bangui, which is the only children's hospital in the city. From March to August 2007, all children aged between one and 59 months who had

acute diarrhoea (at least three stool passages per day) for less than five days and who did not receive any antibiotics were included in this study after parents or a tutor gave formal consent. The parent or tutor was asked about the characteristics of the stools: mucoid, and/or watery, and/or bloody. These observations were noted macroscopically by the investigator when the stool samples were collected for laboratory analysis. A total of 156 children from Bangui city and its periphery were included, of whom 84 were male (sex-ratio = 1.2). The mean age was 12.4 months, and 57% of the children were between one and 11 months.

Fresh stool specimens were collected in a sterile container and brought within one hour to the laboratory of the Institut Pasteur de Bangui where a rapid test for qualitative detection of rotavirus and adenovirus (VIKIA Rota-Adeno, BioMerieux, Marcy l'Etoile, France) was performed before bacteriology.

Bacteriology

Systematic Gram coloration was performed on all samples. During this analysis, microscopic bloody stools were noted as well as the Gram characteristics for bacterial positive samples. The stools samples were then inoculated immediately with Hektoen, (BioMérieux), Bromocresol Purple (Bio-Mérieux), and Mac Conkey sorbitol (Becton Dickinson, Sparks, MD, USA) agar, and on selenite media (Bio-Rad, Marnes-la-Coquette, France) for enrichment. Non-lactose-fermenting strains were systematically tested for their urease activity and for their manitol motility. *Shigella* strains were identified with API 20E strips (BioMérieux) and agglutinated with sera against *Shigella dysenteriae*, *Shigella flexneri*, *Shigella boydii* and *Shigella sonnei* (Bio-Rad).

Antimicrobial susceptibility testing was done by disk diffusion on Mueller–Hinton agar as recommended by the Antibiogram Committee of the French Society for Microbiology (CA-SFM) [5]. The following antimicrobials (Bio-Rad) were tested: amoxicillin, amoxicillin–clavulanic acid, ticarcillin, cefoxitin, cefotaxime, cephalotin, chloramphenicol, tetracycline, gentamicin, nalidixic acid, ciprofloxacin, streptomycin, sulphonamides and sulphamethoxazole–trimethoprim. Diameters were measured with the automated Osiris system (Bio-Rad). Bacteria were classified as susceptible, intermediate, or resistant, according to the CA-SFM interpretation of results.

Data analysis

Data were entered and analyzed using Epi Info 3.3.2 software (Centers for Disease Control and prevention, Atlanta, USA).

Results

Stools were watery (67.3%), mucoid (25.6%) or bloody (7.1%). *Shigella* strains were isolated from 15 samples (9.6 %) and all identified as *Shigella flexneri*. A total of 11 (73.3%) of the samples were from female children. Cases were distributed independently of the social and economic status of their families. Two of the infected children died of dehydration. Seven stools contained *Salmonella enterica*. Rotavirus and adenovirus were found respectively in 14 and 7 stools, which tested negative for *Salmonella* and *Shigella*.

Most strains of *Shigella flexneri* were resistant to amoxicillin, chloramphenicol, cotrimoxazole tetracycline and streptomycin; nine different patterns of resistance were observed. All the strains remained

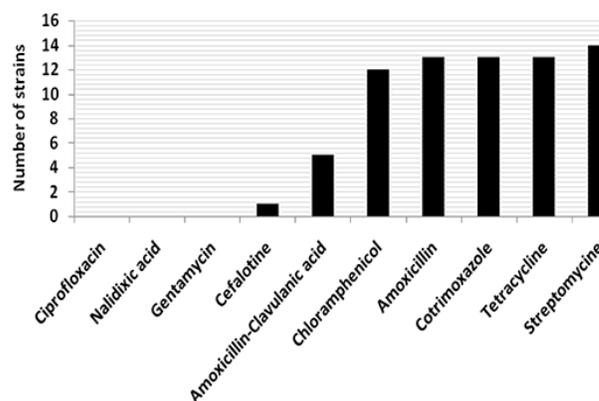
susceptible to nalidixic acid and ciprofloxacin. Details are shown in Table 1 and Figure 1.

Table 1. Resistance profiles of *Shigella flexneri* isolated at the ‘Complexe Pédiatrique’ of Bangui, CAR

Resistances	Frequency
AMX S C	1
AMX S C Te	1
AMX S C SXT Te	1
AMX S C SXT	1
AMX SXT Te	1
AMX AMC CF S C SXT Te	1
S SXT Te	2
AMX S C SXT Te	3
AMX AMC S C SXT Te	4
Total	15

AMX : amoxicillin ; AMC : amoxicillin-clavulanic acid ; S : streptomycine ; C : chloramphenicol ; SXT : cotrimoxazole ; Te : tetracycline ; CF : cefalotine

Figure 1. Susceptibility of *Shigella flexneri* to antibiotics in Bangui, CAR



Discussion

Children under five years of age are a high-risk group for diarrhoea. *Shigella* is a major cause, as reported in Senegal, Djibouti and Zambia, where it represents respectively 11%, 15% and 10.2% of enteropathogenic agents [6-8]. A previous study in Bangui in 1983 found only 2.2% of diarrhoea attributable to *Shigella* (9). Such an increase in prevalence is supported by World Health Organization data, which demonstrates a regular

increasing trend of *Shigella* in sub-Saharan countries in the last ten years [10].

In 2003, 2004 and 2005, *Shigella dysenteriae* was responsible for two epidemic episodes in CAR [4, 11], but in our hospital survey, *Shigella flexineri* was the only species isolated. Thus, *Shigella flexineri* is apparently endemic to the population as described in Tunisia, while *Shigella dysenteriae* would be mainly associated with outbreaks [3].

The management of shigellosis is a problem due to its acquired resistance to commonly used antibiotics, which is increasing. Fortunately, ciprofloxacin has retained its efficiency, although it is given orally, which may create a problem in seriously ill children. Nevertheless, as recently reported by Bercion and collaborators in 2008, the full sensitivity of *Shigella* to quinolones is an unexpected advantage for practitioners in the treatment of shigellosis in CAR. However, this advantage is not common elsewhere in Africa [13].

It has been reported that shigellosis prevalence is extensively underestimated because *Shigella* are very fragile and sometimes in low number in faeces, which necessitates inoculation of media within four hours after stool emission and the use of enrichment medium [14]. In the current study, this disadvantage was taken into account. The authors minimized the risk of missing a diagnosis of shigellosis by a rapid inoculation of media, which was facilitated by the vicinity of the two institutions. It should also be noted that *Shigella* is the most prevalent pathogen found, which justifies improving the diagnosis of shigellosis in everyday practice. Although molecular techniques are rapid and sensitive in the diagnosis of *Shigella* infection, they cannot be put into practice on a routine basis. *Shigella* remains a burden in developing countries; sensitization of the population and practitioners to this lethal infection (2/15 in the current study) would contribute to limiting its severity and prevalence.

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