ANTIBIOTIC SUSCEPTIBILITY PATTERNS OF *VIBRIO CHOLERAE* ISOLATES IN GHANA

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SUMMARY

Strains of Vibrio cholerae isolated from stool cultures on TCBS from various hospitals in Ghana were identified using API 20E and serotyped with both monovalent and polyvalent sera. Susceptibility to 10 antimicrobial agents was tested by the disc diffusion method of Kirby-Bauer. Both ogawa and inaba strains were identified. Ninety-three percent (93%) of isolates were sensitive to tetracycline and nalidixic acid. All isolates were resistant to trimethoprim-sulphamethoxazole and colistin. Several strains showed intermediate sensitivity to chloramphenicol, ampicillin and amoxycillin-clavulanic acid. We conclude that tetracycline is still a useful drug for the treatment of cholera in Ghana.

Keywords: *Vibrio cholerae*, susceptibility, antimicrobials, Ghana.

INTRODUCTION

Cholera is a diarrhoea disease caused by Vibrio cholerae. Seven distinct pandemics had occurred since recording started in 1817[1]. In 1961, the latest – 7th pandemic started from Sulawesi an Indonesian island. This was caused by the El Tor biotype and it spread across Asia into Africa[2]. The pandemic reached Ghana in November 1970[3]. In the West African region more than 150,000 cases were reported with over 2,000 deaths in one year during the peak of the epidemic[4]. Since then, epidemics of cholera had been reported in Ghana for several years, with seasonal outbreaks in different regions of the country. In recent years, the morbidity and mortality for cholera has decreased in many countries including Ghana, possibly because the organism has become endemic and clinical management of the disease has improved. This may have led to relaxed control measures because endemic cases are just a few per year. For example, in the year 2000 and 2001, the National Surveillance unit of the Ghana Health Service reported 3431 and 5483 cases of cholera respectively.

There are several serogroups of *V. cholerae*, the 01 serogroup being the cause of endemic and epidemic cholera. Using specific antisera to detect different fractions of the O antigen, the 01 serogroup is divided into Inaba (AC), Ogawa (AB) and Hikojima (ABC) serotypes[5]. Drug resistant *V. cholerae* have been reported since 1977 and some of these strains were multidrug resistant[6-8]. Although most of these instances of resistance were chromosomal, plasmid-coded resitance has been reported[9]. Due to the development of these resistant strains, comparative trials have been done to evaluate treatment regimes for the management of infection caused by tetracycline-resistant strains[10-12] and newer antimicrobial agents like ciprofloxacin have been tried for treatment of cholera. It is now important to know the local antimicrobial susceptibility patterns of *V. cholerae*.

Susceptibility of *V. cholerae* to various antimicrobial agents has not been previously reported in Ghana. We conducted this study to review the susceptibility patterns of *V. cholerae* isolates from the southern part of Ghana.

METHODS

V. cholerae strains isolated from stool cultures on thiosulphate-bile salts-sucrose agar (TCBS) in 1999 in Accra (Korle Bu Teaching Hospital, Public Health Reference Laboratory and 37 Military Hospital) and also Kumasi (Komfo Anokye Teaching Hospital) were identified by using API 20E

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(bioMérieux SA. Marcy l'Etiole, France), and serotyped with both polyvalent and monovalent sera (Difco Laboratories Detroit USA). Antibiotic susceptibility testing was done in the Noguchi Memorial Institute of Medical Research, Accra, Ghana by the Kirby – Bauer disc diffusion method[13]. Ten antimicrobial agents were tested, namely – tetracycline (30), ampicillin (10), amoxycillin-clavulanic (20/10), nalidixic acid (30), trimethoprim-sulphamethoxazole [TMP-SMX] (25), chloramphenicol (30), cefaclor (30), cefuroxime (30), cefotaxime (30), and colistin (10). The results were categorized as sensitive or resistant based on standardized zones of inhibition.

RESULTS

There were a total of 23 strains of *V. cholerae*, made up of ten Inaba and thirteen Ogawa serotypes. Ninety-three percent (93%) of all isolates were sensitive to tetracycline, and nalidixic acid, but all isolates were resistant to TMP-SMX and colistin. As indicated in Table 1, several isolates show intermediate sensitivity to chloramphenicol, ampicillin, amoxycillin-clavulanic acid.

Table 1 Antimicrobial percentage susceptibility of V. cholerae (n=23)

Drugs	Sensitive No. (%)	Intermediate No. (%)	Resistant No. (%)
Tetracycline	21(93)	0	2(7)
*TMP-SMX	0	0	23(100)
Chloramphenicol	10(43)	12(52)	1(4)
Ampicillin	7(29)	11(47)	5(24)
**Augmentin	2(9)	15(65)	6(26)
Nalidixic acid	21(93)	0	2(7)
Cefaclor	12(52)	5(22)	6(26)
Cefuroxime	17(74)	0	6(26)
Cefotaxime	12(52)	5(22)	6(26)
Colistin	0	0	23(100)

*TMP-SMX Trimethoprim-sulphamethoxazole
**Augmentin Amoxycillin-clavulanic acid

DISCUSSION

Although there were only 23 strains, the results nevertheless are important as it is the first time that a study of susceptibility tests using several antimicrobial agents is being reported from Ghana. Almost all isolates were sensitive to tetracycline and nalidixic acid. Tetracycline is therefore still useful in the management of cholera epidemics in Ghana.

Since some isolates had intermediate susceptibility results to some of the drugs tested-chloramphenicol, amoxycillin-clavulanic acid and ampicillin, in future there is the need for mean inhibitory concentration (MIC) testing of vibrio strains as the intermediate results may indicate serious problems in later years.

Changes in antimicrobial resistance of *V. cholerae* strains over the years had been reported form some African countries. In a 1993 Kenyan study, majority of strains were resistant to tetracycline and ampicillin[14]. Another study 11 year later (1994) showed 100% resistance to ampicillin but susceptibility to tetracycline stayed the same[7]. A more alarming trend was that of a report from Tanzania – during the five-month period of a study 1977/1978 (when mass prophylaxis was given using Tetracycline), resistance to tetracycline rose from 0 to 76%[6]. Tetracycline resistance in Tanzania in 1994 was reported as being 100%[7]. In a Rwandan refugee camp in Zaire, a major outbreak in 1984 was due to a strain that was 100% resistant to Tetracycline[8]. In Somalia, it is believed that pockets of resistant isolates exist in some areas[7]. It may sometimes be necessary therefore to study the resistance pattern of isolates from various areas within a country.

Since the reports on multi-resistant strains appeared in the literature, antimicrobial agents other than tetracycline are being tried for the management of cholera. These include: erythromycin, trimethoprim-sulphamethoxazole (TMP-SMX), ampicillin, furazolidone, norfloxacin and ciprofloxacin. In 1989, erythromycin was reported to be effective for the treatment of tetracycline resistant strains[10]. In a 1992, Bangladesh study[11] showed there was 100% bacteriological clearance of organisms in 24 hours with the use of ciprofloxacin while bacteriological clearance with erythromycin was 20% and that of tetracycline was 8.3%, during the same period of treatment. *V. cholerae* rapid clearance with ciprofloxacin suggests that short-course therapy may be effective for the treatment of cholera. Norfloxacin was also found to be superior to TMP-SMX in reducing stool output[12]. The use of ciprofloxacin and norfloxacin for management of cholera need to be studied further, for although they are available in developing countries – where most of the problems of cholera exist- they are relatively more expensive when compared to drugs like tetracycline and erythromycin. They are also used as reserve drugs for the treatment of serious infections caused by other multiresistant micro-organisms.

This report on the susceptibility of *V. cholerae* to various antimicrobial agents can help health authorities review cholera treatment guideline when

necessary by using the susceptibility patterns of local isolates. Cholera is now an endemic condition in Ghana, it usually starts with the onset of the rainy season in the southern part of the country. In Peru active weekly survey of sewage water was an effective means of predicting an outbreak of cholera several weeks before significant number of cases occurred and this helped public health personnel to target health education messages to specific communities at risk[15]. Intensive health education campaigns should be organized to continually remind the population about prevention of diarrhoeal diseases and existing laws on sanitary disposal of sewage must be enforced.

ACKNOWLEDGEMENT

We acknowledge the contribution of technical staff of the various institutions for isolation of Vibrio strains and especially Mr. Bright Sakyi and Mr. Lorenzo Akyeh (Noguchi Memorial Institute for Medical Research, University of Ghana) for technical assistance.

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