

ANTIBIOTIC SENSITIVITY OF SHIGELLAE ISOLATED IN
CHOLERA RESEARCH LABORATORY BETWEEN
JANUARY 1971 TO JANUARY 1975

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Introduction

Shigella strains resistant to multiple antibiotics were first recognized in 1955. Since that time epidemics of shigellosis due to multiply resistant organisms have been documented in Japan (1), England (2), and Central America (3). In Japan, during 1968-1970, about 93% of Shigella isolates were resistant to one or more of the drugs streptomycin, tetracycline, chloramphenicol and sulfadiazine (4).

In Bangladesh, shigellosis was a relatively minor problem before the war in 1971. Since that time, however, its importance has increased. Our previous observations on shigella isolated in Dacca showed that by 1970, 75% of Shigella dysenteriae type I and 27% of Shigella flexneri were multiply-resistant. This phenomenon of resistance to one or more antibiotics has created a serious problem for the clinician in choosing the proper antibiotics for the treatment of acute shigellosis.

Considering the increased evidence of multiple resistant shigellae in Bangladesh and the consequent problems of treatment, we began monitoring the changing antibiotic sensitivity pattern of shigellae isolated in the Cholera Research Laboratory.

Materials and Methods

The shigellae included in this study were isolated from both inpatients and outpatients. Colonies were picked from either MacConkey's agar or Salmonella-Shigella agar and identified biochemically and subsequent serotyping with commercial antisera.

The antibiotic sensitivities were performed using Oxoid

Multodisks on Mueller-Hinton agar. Each Multodisk contained a disk of streptomycin, tetracycline, chloramphenicol, ampicillin, kanamycin, furazolidone.

Results

During the period, January 1971 - January 1975, 3956 shigellae were isolated. The annual distribution and percentage of isolation according to species is shown in table I. The period 1972-1973 showed an epidemic of Shigella dysenteriae type I. However, since August 1974, the numbers of Shigella dysenteriae type I have been decreasing with a simultaneous rise in the isolations of other shigella species, particularly Shigella flexneri.

During the 4 year period, the antibiotic sensitivities of 2388 shigella isolates were determined. Of this number 86% were Shigella dysenteriae type I and Shigella flexneri, which was about equal to the percentage of isolation of these two species.

As shown in table II, the Shigella dysenteriae type I were resistant to streptomycin and tetracycline from the beginning and has remained so. A rise in resistance of Shigella dysenteriae type I to chloramphenicol (4.3% in 1971 to 38% in 1974) was observed during the epidemic period. In the case of Shigella flexneri we have seen a increase in tetracycline resistance from 20.6% in 1971 to 64.6% in January 1975. An increase in resistance to streptomycin has also been observed. No dramatic increases in the resistance to ampicillin or kanamycin in the case of Shigella dysenteriae type I, or in resistance to chloramphenicol, ampicillin or kanamycin in the case of Shigella flexneri were observed during this period. All shigellae remained sensitive to furazolidone.

Table III shows that coinciding with the increase in chloramphenicol resistance in Shigella dysenteriae type I, there has been an increase in multiple resistance from 4.3% in 1971 to 35.6% in 1974. Similarly, coinciding with the increase in tetracycline resistance in Shigella flexneri, an increase in multiple resistance (12.1% in 1971 to 36.7% in January 1975) was observed.

As shown in table IV, in the case of Shigella dysenteriae type (2-10) and Shigella sonnei resistance to streptomycin has remained high over the entire period. With Shigella boydii, there was a rise in resistance to streptomycin from 1972-1974. We have not seen a significant increase in the resistance to tetracycline, chloramphenicol, ampicillin or kanamycin by any of these three serotypes, Shigella dysenteriae type (2-10), Shigella sonnei, Shigella boydii.

Discussion

Multiple resistance in Enterobacteriaceae may develop rapidly after antibiotic administration and is the result of R-factor transfer from resistant bacteria to previously sensitive strains (1). The common resistance pattern of multiply resistant strains of shigella appears to be related to the type of antibiotic usage in different parts of the world. The most frequent resistance pattern in Japan is sulfonamide, streptomycin, tetracycline, and chloramphenicol, reflecting the widespread clinical use of those four antibiotics (1). The common resistance pattern emerging in Bangladesh is streptomycin, tetracycline and chloramphenicol in the case of Shigella dysenteriae type I. The increase in multiple resistance in Shigella dysenteriae type I may be correlated with the extensive use of chlorostep, a drug containing the antibiotics chloramphenicol and streptomycin, for the treatment of shigellosis. Similarly, in Shigella flexneri the increase in resistance to tetracycline and multiple resistance, may be correlated with the indiscriminate use of tetracycline in the treatment of diarrheal disease in Bangladesh.

Since Shigella dysenteriae type I and Shigella flexneri account for about 85% of the total shigella isolates at the Cholera Research Laboratory, tetracycline should no longer be considered the drug of choice in treating shigellosis. Although we have isolated a few ampicillin resistant strains, the number is small compared to that in other countries, and ampicillin can be considered the drug of choice for treating shigellosis at the Cholera Research Laboratory.

References

1. Watanabe, T., 1963. Infective heredity of multiple drug resistance in bacteria. Bact. Rev. 27: 87-115.
2. Davis, J.R., W.N. Farrant, H.C. Uttley, 1970. Antibiotic Resistance of *Shigella sonnei*. The Lancet 2: 1157-1159.
3. Mata, L.J., E.J. Gangarosa, A. Caceres, D.R. Perera, and M.L. Mejicanos, 1970. Epidemics of Shiga bacillus dysentery in Central America. I. Etiologic investigation in Guatemala, 1969. J. Infect. Dis. 122: 170-180.
4. Tanaka, T., M. Tsunoda, and S. Mitsuhashi, 1973. Distribution of R-factors among *Shigella* strains isolated in Japan (11). Jap. J. Microbiol. 17: 291-295.

TABLE I

NUMBER AND PERCENTAGE OF SHIGELLAE ISOLATED AND TESTED
FOR ANTIBIOTIC SENSITIVITY AT THE CHOLERA RESEARCH
LABORATORY, BETWEEN JANUARY 1971 TO JANUARY 1975

Year	Shigella dysenteriae type I		Shigella dysenteriae type (2-10)		Shigella flexneri		Shigella boydii		Shigella sonnei		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	
1971	34	14.5	21	8.9	165	70.0	1	0.4	14	5.9	235
1972	395	38.2	73	7.1	471	45.6	24	2.3	71	6.9	1034
1973	311	51.8	25	4.2	215	35.8	29	4.8	20	3.3	600
1974	333	17.1	103	5.3	1285	66.2	136	7.0	85	4.4	1942
1975 (January)	17	11.7	8	5.5	107	74.0	10	7.0	3	2.0	145
Total - isolation	1090	27.6	230	5.9	2243	56.7	200	5.1	193	4.9	3956
Total isolates tested for antibiotic sensitivity	844	35.3	114	4.8	1214	50.8	115	4.8	101	4.2	2388

TABLE II

ANTIBIOTIC RESISTANCE OF ISOLATES OF SHIGELLA DYSENTERIAE
TYPE I AND SHIGELLA FLEXNERI ISOLATED BETWEEN
JANUARY 1971 - JANUARY 1975

	Year	No. of Isolates	% Of All Isolates Resistant To					
			Sm	Tc	Cm	Amp	K	Fx
Shigella dysenteriae type I	1971	23	100	100	4.3	0	0	0
	1972	359	93.9	96.9	21.2	0.6	0	0
	1973	276	91.6	97.5	23.2	1.4	0	0
	1974	171	84.2	98.2	38.0	2.3	0.6	0
	1975 Jan.	15	100	100	20.0	0	0	0
Shigella flexneri	1971	141	51.1	20.6	4.3	2.8	0.7	0
	1972	258	41.9	23.6	7.0	5.0	0	0
	1973	202	32.6	35.1	3.0	1.0	1.0	0
	1974	534	46.2	43.8	5.4	3.9	0.7	0
	1975 Jan.	79	62.0	64.6	7.6	6.3	0	0

Sm = Streptomycin
Tc = Tetracycline
Amp = Ampicillin
K = Kanamycin
Fx = Furazolidone
Cm = Chloramphenicol

TABLE III

MULTIPLY RESISTANT ISOLATES OF SHIGELLA DYSENTERIAE
TYPE I AND SHIGELLA FLEXNERI ISOLATED
BETWEEN JANUARY 1971 - JANUARY 1975

	Year	No. of Isolates	% Resistant to*					
			0 drug	1 drug	2 drugs	3 drugs	4 drugs	5 drugs
Shigella dysenteriae type I	1971	23	0	0	95.7	4.3	0	0
	1972	359	0.3	7.2	73.0	19.2	0.6	0
	1973	178	0.6	9.0	66.3	22.5	1.7	0
	1974	146	1.4	14.4	45.9	35.6	2.7	0
	1975 Jan.	15	0	0	80.0	20.0	0	0
Shigella flexneri	1971	141	41.8	43.3	12.1	0	2.1	0.7
	1972	258	50.4	29.8	13.2	5.0	1.6	0
	1973	89	55.5	23.6	15.7	5.6	0	0
	1974	413	39.0	31.0	25.2	3.4	1.0	0.5
	1975 Jan.	79	17.7	38.0	36.7	1.3	6.3	0

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* 1 drug - usually Sm or Tc; 2 drugs - usually Sm, Tc;

3 drugs - usually Sm, Tc, Cm (Shigella dysenteriae type I) and usually Sm, Tc, Cm; Tc, Cm, Amp; or Sm, Tc, Amp (in Shigella flexneri)

4 drugs - usually Sm, Tc, Cm, Amp;

5 drugs - Sm, Tc, Amp, K, Cm.

TABLE IV

ANTIBIOTIC RESISTANCE OF ISOLATES OF SHIGELLA DYSENTERIAE TYPE (2-10)
SHIGELLA BOYDII, AND SHIGELLA SONNEI ISOLATED BETWEEN
JANUARY 1971 - JANUARY 1975

	Year	No. of Isolates	% Of All Isolates Resistant To					
			Sm	Tc	Cm	Amp	K	Fx
Shigella dysenteriae type(2-10)	1971	20	85.0	5.0	5.0	0	0	0
	1972	35	77.1	8.6	2.9	0	0	0
	1973	13	61.5	8.0	0	0	0	0
	1974	38	76.3	8.0	0	0	0	0
	1975 Jan.	8	75.0	12.0	0	12.0	0	0
Shigella sonnei	1971	13	46.2	7.7	0	0	0	0
	1972	39	51.3	12.8	0	0	0	0
	1973	4	50.0	0	0	0	0	0
	1974	43	46.5	5.9	3.9	3.9	0	0
	1975 Jan.	2	50.0	0	0	0	0	0
Shigella boydii	1971	1	0	0	0	0	0	0
	1972	29	17.2	10.3	3.4	3.4	0	0
	1973	8	37.5	17.9	7.1	0	0	0
	1974	72	43.1	17.8	2.2	4.4	3.3	0
	1975 Jan.	5	20.0	0	0	0	0	0

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