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IP International Journal of Medical Microbiology and Tropical Diseases

Journal homepage: https://www.ijmmtd.org/

Original Research Article

Epidemiological fectors and antibiotic susceptibility pattern of *Salmonella spp*

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ARTICLE INFO

Article history:
Received 15-06-2021
Accepted 04-08-2021
Available online 01-09-2021

Keywords:
Multi drug resistant
Nalidixic acid resistance
Salmonella typhi
Typhoid

ABSTRACT

Background: *Salmonella enteric* serovars Typhi and Paratyphi are known to cause enteric fever. Multidrug resistance in *S. Typhi* and *S.Paratyphi* has emerged as a cause of concern.
Aims: To evaluate antimicrobial susceptibility patterns of Salmonella enteric serovar Typhi (*S. Typhi*) and *S.Paratyphi* obtained from blood culture.
Materials and Methods: All *S. enteric* isolates obtained from blood cultures of clinically suspected cases of enteric fever coming to microbiology laboratory, Nirmal hospital, from January 2015 to September 2017 were included in the study. Antimicrobial susceptibility patterns were determined using commercial antimicrobial disks chloramphenicol (30 μg), nalidixic acid (30 μg), ampicillin (10 μg), azithromycin (15 μg), cotrimoxazole (1.25/23.75 μg), ciprofloxacin (5 μg), and ceftriaxone (30 μg). Antimicrobial susceptibility testing was performed in accordance with the Clinical and Laboratory Standards Institute (CLSI) guidelines of respective year by KirbyBauer disc diffusion method.
Result: Total 330 isolates of salmonella are there out of that 298 is *Salmonella typhi*. 32 are Salmonella para A, while 1 is of Salmonella para B. Enteric fever cases pick month are April, May, June and July. Sensitivity to first line drugs are > 80%, Nalidixic acid resistant Salmonella (NARS) are 79%, while Multi drug resistant (resistant to ampicillin, chloramphenicol and co-trimoxazole all three)Salmonella are 3%.
Conclusion: Periodic evaluation of antibiotic susceptibility pattern is necessary to see changing pattern of antibiotics. Evaluation of Nalidixic acid resistant Salmonella and periodic evaluation of multi drug resistant Salmonella is also important as emergence of MDR strain is observed in our study.

1. Introduction

Salmonella infections are a big public health concern around the world. Antibiotic resistance and multi resistance of Salmonella spp. have developed dramatically in the recent decade, particularly in poor countries, as a result of increased and indiscriminate antibiotic usage in the treatment of humans and animals. Annually, it is predicted that 22 million new cases of enteric fever are diagnosed. South Central Asia and Southeast Asia have the highest rates of enteric fever (> 100 cases per 100,000 people per year). Except for Australia and New Zealand, the rest of Asia, Africa, Latin America, the Caribbean, and Oceania have a moderate incidence (10-100 cases per 100,000 people per year).[1]

In poor countries, such as India, enteric fever is a major public health issue. In areas with poor hygiene and sanitation, many human-restricted diseases are spread by the faecal channel, resulting in high morbidity and mortality. Appropriate antimicrobial therapy can help to minimise the disease's morbidity and mortality. Antibiotic therapy is the cornerstone of enteric fever treatment, with fatality rates as high as 30% in untreated patients and as low as 1% with proper antibiotic therapy. Enteric fever is caused by

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https://doi.org/10.18231/j.ijmmtd.2021.030

Salmonella enteric serovar Typhi and Paratyphi A, which are the most common etiological agents in India, especially during the summer.[2]

Since 1960, multidrug-resistant *S. Typhi* has been observed, resistant to all three antityphoidal antimicrobial agents: ampicillin, chloramphenicol, and cotrimoxazole.[3] The first epidemic of multidrug-resistant *S. Typhi* (MDRST) was recorded in Calicut.[4]

2. Materials and Methods

Salmonella isolates obtained from blood cultures received for routine bacterial culture sensitivity at the microbiology laboratory between January 2015 and September 2017 were included in the study. The study protocol was approved by the hospital ethics committee. A retrospective analysis of laboratory records was carried out over these 3 years. Only one isolate per patient was included. All the blood culture samples were processed by the automated blood culture system-BACTEC 9030 (Becton Dickinson). Collection of blood, incubation, and subcultures onto blood agar and Mac-Conkey agar were done as per the standard methods. Suspected non-lactose-fermenting colonies were further processed and identified by biochemical reactions.

Antibiotic susceptibility was performed using the Kirby-Bauer disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI) guidelines for the corresponding years using commercially available disks (Hi-media Laboratories, India) of ampicillin (10 μg), chloramphenicol (30 μg), co-trimoxazole (1.25/23.75 μg), ciprofloxacin (5 μg), cefotaxime (30 μg) and nalidixic acid (NA) (30 μg). *Escherichia coli* ATCC 25922 was used as the quality control strain. Isolates with intermediate levels of resistance in disk diffusion were included in the percentage of resistant organisms for final analysis.

3. Result

From the year January 2015 to September 2017 total 330 blood culture is positive for Salmonella spp. Out of that total 298 are *Salmonella typhi* while 32 *Salmonella. Paratyphi* A which is almost 10% of total.

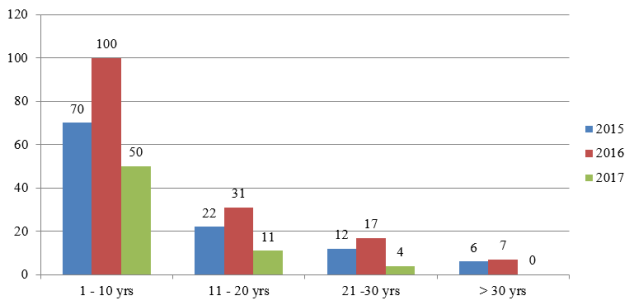

Fig. 1: Age wise distribution of cases (graff 1)

All age group and both sexes are involved. The mean age is 15 years. The male to female ratio was 1.9:1 (graff 1).

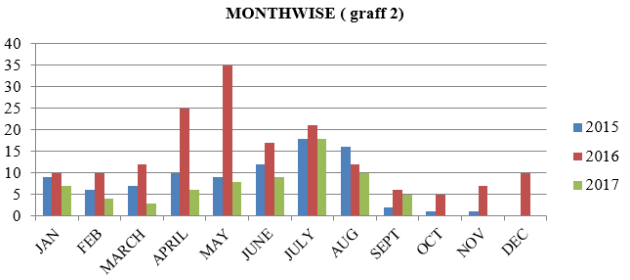

Fig. 2: Month-wise distribution of cases (graff 2)

The peek months are April, May, June and July according to our study (graff 2). *S. typhi* was most susceptible towards cefotaxime (99%), followed by chloramphenicol (90%), Co-trimoxazol (89%), ampicilline (86%), Ciprofloxacin (36%) &Nalidixic acid (20%) (Table 1).

In case of S. paratyphi Amost of the tested antibiotics showed high percentage of susceptibility and the least susceptible antibiotic was Nalidixic acid (16%) followed by Ciprofloxacin (31%) (Table 2).

Out of the 298 S.typhi isolates; 10(3%) isolates were multidrug resistance, showing resistance simultaneous to Ampicillin, Chloramphinicol, and Co-trimoxazole which are first line anti typhoidaldrugs. While considering Nalidixic acid resistant Salmonella(NARS) total 236 S.typhi which is 79% of total *S.typhi* are NARS, While 25 which is 78% out total *S.para* A are NARS.

4. Discussion

In our study 1yr till 30 yrs., age groups are involved with mean age of occurrence is 15yrs. This can be correlated with L Singhal et al studies shows[8] more patient belongs to pediatric age group (< 12 yrs). Contratery to that Raza S et al studies[9] shows most of the positive cases lie in the age group 21-40 years.

The seasonal trend of typhoid fever in our study starts from April, May, June and July. which is been co-relate with L Singhal et al[9] study showing peaked during July-September (rainy seasons) followed by April-June each year.Similar observation is made with Joshi BG[5] study showing the occurrence of the disease was higher during summer and rainy season.

If we compare the antibiotic susceptibility of Salmonella typhi in our study and other studies, it will show you the following results (Table 3).

In our study *Salmonella paratyphiA* shows 100% susceptibility to ampiciin, cefotaximco-trimxazole & Chloremphenicol. While ciprofloxacin is 31% sensitive and Nalidixic acid is 16% sensitive. Similar results are seen with other studies, Joshi BG et al 2011.[5] shows

Table 1: Number of sensitive *S.TYPHI*

	2015(85)	2016(160)	2017(53)	Total(298)
AMP	83	127	47	257 (86%)
CTX	85	160	52	297(99%)
CIP	38	51	18	107(36%)
COT	84	132	48	264(89%)
C	82	138	49	269(90%)
NA	34	12	14	60(20%)

Table 2: Number of sensitive *S.TYPHI PARA A*

	2015(5)	2016(10)	2017(17)	Total(32)
AMP	5	10	17	32(100%)
CTX	5	10	17	32(100%)
CIP	4	3	3	10(31%)
COT	5	10	17	32(100%)
C	5	10	17	32(100%)
NA	2	0	3	5(16%)

Table 3: Comparission of different study with our study

Antibiotics (% of Sensitive)	Joshi BG et al 2011[5]	Gordana Mijovic et al 2012[6]	AshwiniChoudhary et al 2013[7]	In our study, Jan 2015- Sept 2017
Ampicillin (Amp)	76	92	91	86
Cefotaxim (CTX)	100	98	100	99
Ciprofloxacin (CIP)	88	98	54	36
Co-trimoxazole (COT)	100	96	95	89
Chloremphenicl (C)	100	98	100	90
Nalidixic acid (NA)	44	83	8	20

100% sensitivity towards ciprofloxacin, co-trimoxazole and chloramphenicol, while ampicillin is 26% sensitive.

In our study total 261(79%) of salmonella isolates are NARS. Nalidixic acid resistance screening is not a reliable surrogate indicator of ciprofloxacin resistance. Ciprofloxacin MIC should to beroutinely done. While multi drug resistant salmonella are 10(3%), while study with Gordana Mijovic 2012[6]shows 1.8% MDR in theire 2 survey comparision study, while Raza S et al[8] study shows 3 isolates out of 47 showing multi drug resistance. Kavita Nagshetty 2010[10] et al's study shows total 9(10%) MDR isolates. Carbapenems are the antibiotic of choice for organisms showing MDR. In our study imipenem & meropenem are 100% sensitive. Also azithromycin shows 100% sensitivity.

5. Conclusion

In conclusion, Sensitivity pattern of the Salmonella isolates are ever changing. In our study maximum isolates are Salmonella typhi followed by Salmonella para A and only one isolate is of Salmonella para B. Sensitivity to first line anti-typhoidal drugs are >80%. while sensitivity to Nalidixic acid is 20% only and to ciprofloxacin is 36%. Also increasing resistance to Nalidixixc acid and there by to quinolones is alarming and of particular concern to do MIC levels for ciprofloxacin. Multi-drug resistant salmonella are 10(3%) in three year span, but definitely indicating the up-surgence of MDR strain in Surat. While all carbapenem and Azithromycin are 100% sensitive. Which are the alternative mode of treatment of MDR isolates.

6. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

7. Source of Funding

None.

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Cite this article: Patel A, Choraria N. Epidemiological fectors and antibiotic susceptibility pattern of *Salmonella spp*. *IP Int J Med Microbiol Trop Dis* 2021;7(3):137-140.