Antibiotic Sensitivity Pattern of Salmonella Typhi in a Stand Alone Lab in Central Madhya Pradesh

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Abstract

Introduction: Typhoid fever or enteric fever, is an endemic disease in many developing countries specially India and the Indian Subcontinent. In the past decade, resistance of Salmonella to multiple drugs is on the rise specially resistant to ampicillin, chloramphenicol and cotrimoxazole. This resistant pattern has resulted in use of Fluoroquinolones and third generation Cephalosporins as first line drugs.)The present study was under taken to study the antibiotic susceptibility pattern of S.typhi isolated from blood cultures in our microbiology laboratory.

Materials and Methods: 766 patients suspected of having typhoid fever of different age groups and sex visiting our Microbiology department for blood culture were included in the study from January 2015 to December 2015. Gram negative non lactose fermenting colonies were subjected to identification and antibiotic susceptibility testing in Vitek II (Biomerieux) according to CLSI guidelines.

Results: Out of 766 blood cultures, 32 cases of S.typhi were isolated. 561 cultures were sterile and 73 showed growth of other bacteria. Colistin, Cefuroxime, Imipenem, Meropenem showed 100% sensitivity. Piperacillin/Tazobactam, Tigecyline. Cefoperazone/Sulbactam were sensitive in 93.75% isolates. Amoxicillin/Clavulanic Acid (90.62%), Ceftazidime(87.5%), Trimethoprim/Sulfamethoxazole (87.5%), Ticarcillin(84.37%), Ampicillin (81.25%),Cefepime(78.12%), Cefalotin(75%), Amoxycillin(65.62%), Cefixime(59.37%). Cefoxitin(43.75%), Amikacin(31.25%), Gentamicin(6.75%), Ciprofloxacin was found to be resistant in all 32 cases(100%).

Conclusion: There has been a reemergence in the sensitivity of Salmonella Typhi to Ampicillin, Ceftazidime, Cefuroxime Ceftriaxone, Cefoperazone/Sulbactum Cefipime and Amoxyclav and 100% resistance to Ciprofloxaxin and to Amikacin & Gentamycin. Cefuroxime, Ceftriaxone, Cefoperazone/Sulbactum seem to be good therapeutic options is our setting atpresent.

Key words: Antibiotic susceptibility, Salmonella Typhi, Typhoid fever

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Introduction

Typhoid fever or enteric fever, is an endemic disease in many developing countries specially India and the Indian Subcontinent.[1,2] The endemicity in India is quite significant with a morbidity rate of approximately 102 to 2219 per lakh population.[3] According to WHO, 16.6 million cases of typhoid fever are diagnosed annually and mortality due to it is approximately 6 lakhs per annum.[4] Typhoid fever is caused by Salmonella enterica var Typhi (S.typhi) and Salmonella enterica Var Paratyphi A (S.Paratyphi A) being the major causative microorganisms. The pathogens are transmitted by the faeco oral route with poor hygienic practices resulting in high morbidity and mortality. Antibiotic therapy is the mainstay of managing enteric fever. In untreated cases a chance of developing a carrier state increases.In the past decade, resistance of Salmonella to multiple drugs is on the rise specially resistant to ampicillin, chloramphenicol and cotrimoxazole. This resistant pattern has resulted in use of Fluoroquinolones and third generation Cephalosporins as first line drugs.[5,6]The present study was under taken to study the antibiotic susceptibility pattern of S.typhi isolated from blood cultures in our microbiology laboratory.

Material and Methods

766 patients suspected of having typhoid fever of different age groups and sex visiting our Microbiology department for blood culture were included in the study from January 2015 to December 2015.Blood samples were collected with strict aseptic precautions and after following standard protocols in BacT Alert blood culture bottles. The bottles were immediately incubated in the BacT Alert system. The bottles which indicated growth were further sub cultured on Blood and MacConkey Agar plates and a Gram's stain was also prepared. Non lactose fermenting colonies were processed by preparing a Gram's Stain. Gram negative non lactose fermenting colonies were then subjected to

identification and antibiotic susceptibility testing in Vitek II (Biomerieux) according to CLSI guidelines.

Results

Out of 766 blood cultures, 32 cases of S.typhi were isolated. 561 cultures were sterile and 73 showed growth of other bacteria (Table1). The susceptibility pattern of S.Typhi is shown in Table 2

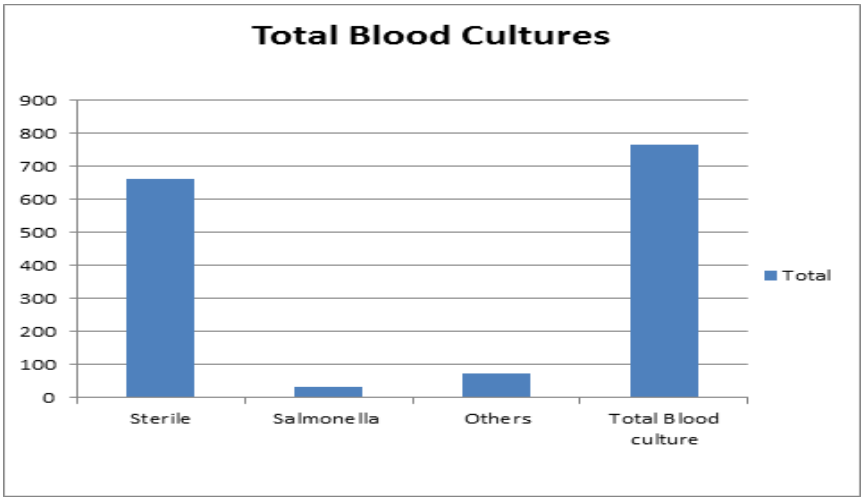
The patients in which S.typhi was isolated were divided into paediateric age group (< 15 years) and adult age group (> 15 years).11 were in paediatric age group and 21 were in adult age group. The highest prevalence rate (65.62%) was found in adult age group (> 15 years).

Table 3 shows isolation of S.typhi in relation to age groups. The sensitivity pattern of all 32 S. typhi isolates showed sensitivity to Ceftazidime, Cefoperazone/ Sulbactam, Piperacillin/ Tazobactam, Cefepime, Imipenem, Meropenem, Trimethoprim/ Sulfamethoxazole, Tigecyline. All 32 isolates showed Resistant to Ciprofloxacin.

Colistin, Cefuroxime, Imipenem, Meropenem showed 100% sensitivity. Piperacillin/Tazobactam, Tigecyline. Cefoperazone/Sulbactam were sensitive in 93.75% isolates. Sensitivity of Amoxicillin/Clavulanic Acid (90.62%), Ceftazidime(87.5%), Trimethoprim/ Sulfamethoxazole (87.5%), Ticarcillin(84.37%), Ampicillin (81.25%), Cefepime (78.12%), Cefalotin (75%), Amoxycillin (65.62%), Cefixime (59.37%). Cefoxitin (43.75%), Amikacin (31.25%), Gentamicin (6.75%), Ciprofloxacin was found to be resistant in all 32 cases(100%). Percentage of sensitivity and resistance of all antibiotics is shown in Table 4 and 5.

Table 1: Total Blood Cultures

Culture Status	Total
Sterile	661
Salmonella	32
Others	73
Total Blood culture	766



Graph 1

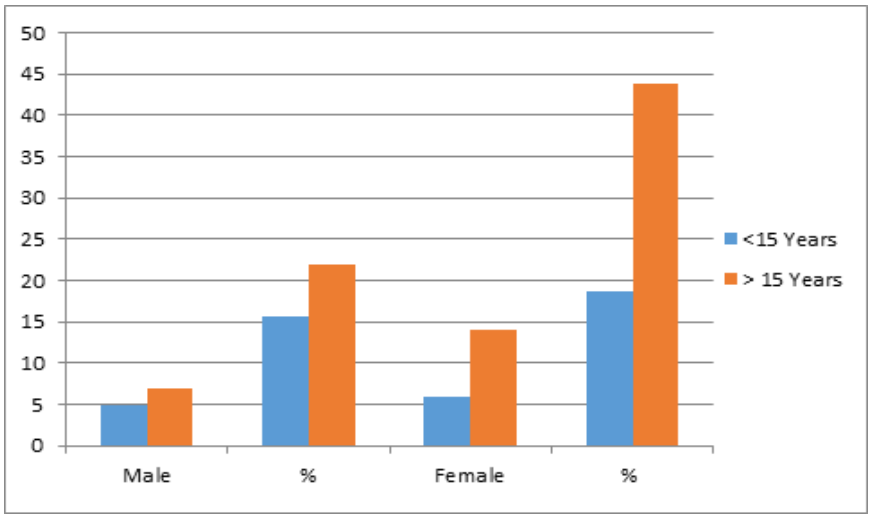
Table 2: Antibiotic Sensitivity Pattern with their MIC's

Name of Antibiotics	Total Sensitive	Sensitive-MIC	Total Resistant	Resistant-MIC
Ampicillin	26	<=2	6	4
Amoxicillin/Clavulanic Acid	29	<=2	3	>=32
Amoxycillin	21	<=2	11	<=32
Amikacin	10	<=2	22	>=64
Ceftazidime	28	<=1	4	>=64
Cefalotin	24	<=2	8	>=64
Cefixime	19	<=0.25	13	>=4
Ciprofloxacin			32	>=4
Ceftriaxone	31	<=1	1	>=64
Colistin	32	<=0.5		

Cefuroxime	32	<=0.5		
Ertapenem	31	<=0.5	1	>=8
Cefepime	25	<=1	7	>=64
Cefoxitin	14	<=4	18	>=64
Gentamicin	2	<=1	30	<=1
Imipenem	32	<=0.25		
Meropenem	32	<=0.25		
Cefoperazone/Sulbactam	30	<=8	2	>=64
Trimethoprim/Sulfamethoxazole	28	<=20	4	>=320
Tigecyline	30	<=0.5	2	>=128
Ticarcillin	27	<=8	5	>=128
Piperacillin/Tazobactam	30	<=4	2	>=128

Table 3: Salmonella typhi isolates in different age groups N= 32

Age Group	Male	%	Female	%	Total	%
<15 Years	5	15.62	6	18.75	11	34.37
> 15 Years	7	21.87	14	43.75	21	65.62
Total	12	37.5	20	62.5	32	100

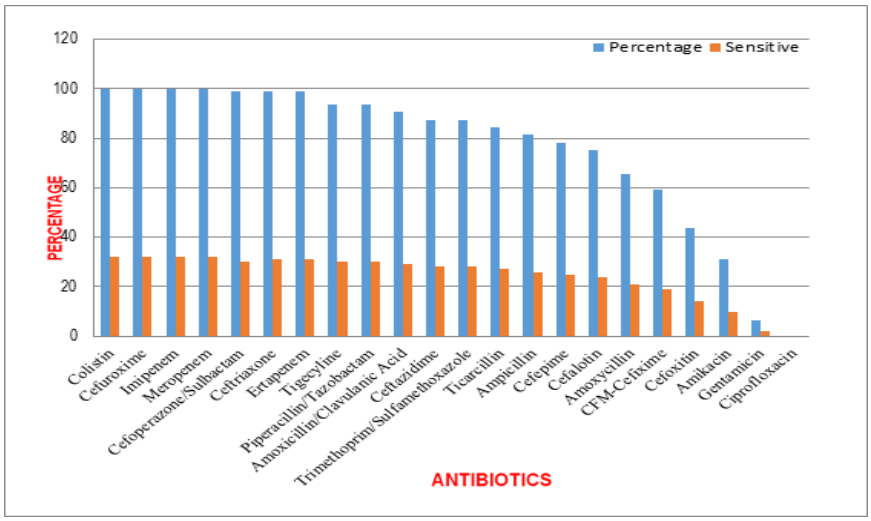


Graph 3

Table 4: Showing Percentage of Sensitive Anitibiotics

Name of Antibiotics	Percentage	Sensitive
Colistin	100	32
Cefuroxime	100	32
Imipenem	100	32
Meropenem	100	32
Cefoperazone/Sulbactam	98.75	30
Ceftriaxone	98.73	31
Ertapenem	98.73	31
Tigecyline	93.75	30
Piperacillin/Tazobactam	93.75	30
Amoxicillin/Clavulanic Acid	90.62	29
Ceftazidime	87.5	28
Trimethoprim/Sulfamethoxazole	87.5	28
Ticarcillin	84.37	27
Ampicillin	81.25	26
Cefepime	78.12	25
Cefalotin	75	24

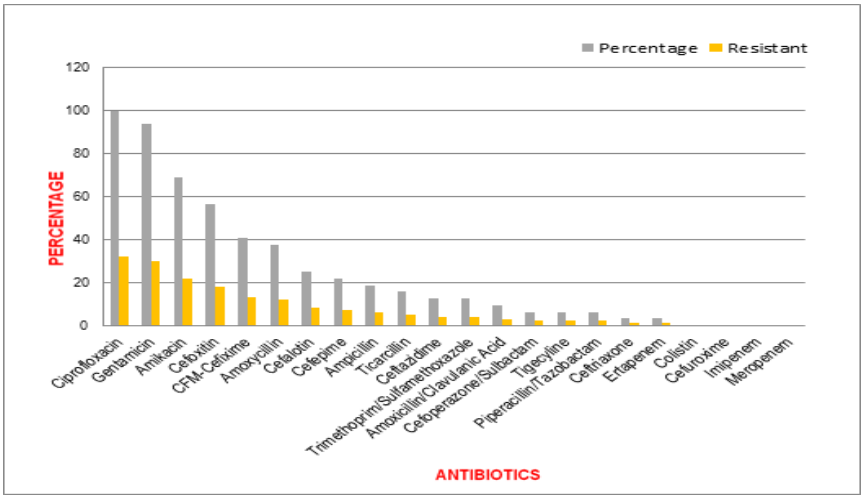
Amoxycillin	65.62	21
CFM-Cefixime	59.37	19
Cefoxitin	43.75	14
Amikacin	31.25	10
Gentamicin	6.25	2
Ciprofloxacin	0	0



Graph 4

Table 5: Showing Percentage of Resistant Anitibiotics

Name of Antibiotics	Percentage	Resistant
Ciprofloxacin	100	32
Gentamicin	93.75	30
Amikacin	68.75	22
Cefoxitin	56.25	18
CFM-Cefixime	40.62	13
Amoxycillin	37.5	12
Cefalotin	25	8
Cefepime	21.87	7
Ampicillin	18.75	6
Ticarcillin	15.62	5
Ceftazidime	12.5	4
Trimethoprim/Sulfamethoxazole	12.5	4
Amoxicillin/Clavulanic Acid	9.37	3
Cefoperazone/Sulbactam	6.25	2
Tigecyline	6.25	2
Piperacillin/Tazobactam	6.25	2
Ceftriaxone	3.12	1
Ertapenem	3.12	1
Colistin	0	0
Cefuroxime	0	0
Imipenem	0	0
Meropenem	0	0



Graph 5

Discussion

Typhoid fever is highly endemic in developing countries, specially in the Indian subcontinent. In India Typhoid fever is a major health problem. Involving high morbidity and economic burden.

The 32 Isolates of Styphi were analyzed for susceptibility pattern of current antibiotics. Out of 32 isolates, Resistance was found in ciprofloxacin (100%), Gentamycin (93.75%), Amikacin (68.75%).

In a study conducted by Akter and Hassan et al in 2012 in Bangladesh, Resistance to ampicillin was 100% and to ciprofloxacin was only 0.27%.[7] No Resistance was found to cefixime, ceftriaxone and Gentamycin. Study by Krishnan et al (2009) showed Sensitivity to Chloramphenicol (86%), Ampicillin (84%) and Cotrimoxazole (88 %). Highest sensitivity was seen for Cefalosporin followed by Quinolones.[8]

Bulbul Hasan et al in their study in 2011 showed 100% sensitivity to Ceftiaxone and Ceftazidime with good sensitivity to Ciprofloxacin and Azithromycin.[9]

Singhal et al in their study in 2014 observed that isolates were resistance to Nalidixic acid and third generation Cephalosporins and 84.5 % isolates had decreasing Ciprofloxacin Susceptibility.[10] Our study correlates to some extent with this study. Adabara N.U. et al in 2012 in their study found multidrug resistance pattern in S.Typhi isolates with resistance to ampicillin, Cotrimoxazole, Ceftriaxone, Cefuroxime, Amoxycillin, Ciprofloxacin.[11]

Enteric fever is a significant health problem in India and is dreaded because of its complications and high incidence of carrier rate if left untreated or because of multiple drug resistance strains.

Since decades, recommended treatment of typhoid fever included ampicillin, trimethoprim-sulfamethoxazole, or chloramphenicol. Emerging drug resistance over the past 20 years has limited the usefulness of these antibiotics.

Presently, quinolone, macrolide, and third-generation cephalosporin antibiotics are preferred for empirical therapy till culture reports are available. Unfortunately, sensitivity to quinolones has been steadily declining. A growing rate of resistance to ceftriaxone has also been reported.[12]

The spread of drug resistance, due to rampant use of the over the counter drugs, self - medication and inadvertent drug use has caused complications in the treatment of the disease. The recent decline in prevalence of Chloramphenicol resistance in many endemic areas has led to the reconsideration of its use as a treatment option but concern about Apalstic Anaemia with its use is a major issue.

Salmonella bacteremia is generally treated with a single drug for 10-14 days. But keeping in mind the resistance pattern, complications and carrier rate it should be treated with a combination of drugs.

Conclusion

Accurate and rapid diagnosis of enteric fever with appropriate antibiotic therapy can substantially reduce the health care burden in developing countries like India.There has been a reemergence in the sensitivity of Salmonella Typhi to Ampicillin, Ceftazidime, Cefuroxime Ceftriaxone, Cefoperazone/ Sulbactum Cefipime and Amoxyclav and 100% resistance to Ciprofloxaxin and to Amikacin & Gentamycin. Cefuroxime, Ceftriaxone, Cefoperazone/ Sulbactum seem to be good therapeutic options is our setting at present.

Conflict of Interest: None

Source of Support: Nil

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