Incidence and Prevalence of Fecal Salmonella and Shigella Isolates and their Antimicrobial Resistance Pattern among Patients, Suffering from Gastroenteritis in Tertiary Care Hospital, at NMCH, Patna

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ABSTRACT

Introduction: On a global scale, diarrhea accounts for approximately 5 million deaths in children annually, making it the leading cause of potential life lost in many parts of the world, especially in developing counties. The present study was undertaken to determine the Incidence and Prevalence of Salmonella and Shigella Isolates in stool culture with their antimicrobial Resistance profiles and to compare them with the Resistance pattern between the periods of May 2019 to February 2021.

Material and Methods:A total of 112 fecal samples were collected from all patients having diarrhea or dysentery aged between more than 1 year to 20 years old.

Results: Out of 112 fecal culture 26 (23.21%) isolates were Shigella species and 51 (45.43%) isolates were Salmonella species. Resistance to antimicrobial agents increased among most of the pathogens between 2019 and 2021. An increase in the rate of resistance was observed in Shigella Species forAzithromycin (from 11.53% to 19.23%), Nalidixic acid (from 7.69% to 15.38%), Cefixime (from 7.69% to 15.38%) and among Salmonella species for Azithromycin (from 13.72% to 27.45%), Nalidixic acid (from 9.8% to 45.09%), Cefixime (from 5.88% to 15.60%).

Conclusion: Routine surveillance of antimicrobial susceptibilities to all classes of clinically used agents is necessary to detect resistance trends, detecting the emergence of new resistance mechanisms that guide infection control measures and public health guidelines. Such trends may help in identifying outbreaks of resistant organisms. Such a check seems to be the best way to find appropriate antibiotic regimens.

Keywords: Diarrhea, Salmonella, Shigella, Antibiotic, Antimicrobial Sensitivity Pattern.

INTRODUCTION

Shigella and Salmonella species are responsible for infectious diarrhea and still causes significant morbidity in the pediatric age group. This problem is especially acute in developing countries, where 0.25% of all death in children aged less than 5 years old are associated with an acute infectious diarrhea, on a global scale, diarrhea accounts for 5 million deaths approx. in children annually, making it the leading cause of potential life lost in many parts in world. Other bacterial agent that causes diarrhea are Escherichia Coli, Enterobacter, Campylobacter, Yersinia enterocolitica, Clostridium perfringens, Cl. defficile and Aeromonas. Diarrhea is controlled by Fluid and Electrolyte replacement by oral hydration or intravenous fluid therapy; however antibacterial agents are also indicated. The sensitivity of commonly prescribed antimicrobials is decreasing both in developing as well as in developed countries. Resistance has emerged even to newer andmore potent antimicrobial agents. Resistance to many antibacterial agents is increasing in many species of Gram-negative, Gram-positive and anaerobic bacteria. Multi-Drug Resistant strains have arisen in a multitude of bacterial species including most species of Enterobacteriaceae[6]. This is important because of their potential for widespread dissemination, acquisition of additional resistance elements and complications in the therapeutic management of patients.

Access to current antimicrobial susceptibility data is utmost importance to clinicians for prescribing the antimicrobial to outdoor patients as well as treating tothe hospitalized patients**.** Knowledge about susceptibility pattern of bacteria in different geographical areas is necessary to control bacterial resistance.

Moreover, updated bacterial susceptibility data are particularly crucial to physicians and infection control practitioners likemicrobiologist in state of Bihar, where over-the-counter antimicrobial consumption and abuse of prescribed antibiotics are widespread.

MATERIAL AND METHODS

The present study was carried out in the Department of Microbiology, Nalanda Medical College, Patna, during the period of May 2019 to April 2021. A total of 112 fecal samples were collected from all the patients having diarrhea or dysentery aged more than one year to 20 years old in clean open mouth disposable container. All the clinical samples were inoculated in Basal, Differential, enrichment and selective medium and incubated at 37°C for 18 to 24 hours.

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Isolation, identification of micro-organisms was carried out by standard biochemical procedures andantimicrobial sensitivity test was done by Kirby-Bauer's disc-diffusion methodaccording to CLSI guidelines[2].

Antibiotics used in this study were Ampicillin, Nalidixic acid, Chloramphenicol, Co-trimoxazole, Azithromycin, Imipenem, Tetracycline, Ciprofloxacin, Levofloxacin, Ofloxacin, Amikacin, Ceftriaxone, Cefixime, Cefotaxime, Ceftazidime, and Furazolidone supplied by Hi-media Laboratories, Mumbai and results were measured according to CLSI guidelines[2].

RESULTS

Out of 112 fecal culture 26 (23.21%) isolates were Shigella species and 51 (45.43%) isolates were Salmonella species. The remaining isolates were E. coli, Klebsiella spp., Pseudomonas spp., Enterobacter spp., and Staphylococcus aureus[3].

An increase in the rate of resistance was observed in Shigella Species forAzithromycin (from 11.53% to 19.23%), Nalidixic acid (from 7.69% to 15.38%), Cefixime (from 7.69% to 15.38%) and among Salmonella species for Azithromycin (from 13.72% to 27.45%), Nalidixic acid (from 9.8% to 45.09%), Cefixime (from 5.88% to 15.60%).

DISCUSSION

The spread of antimicrobial resistance among bacterial pathogens in Patna, Bihar has emerged as an important challenge. Unfortunately, data regarding bacterial resistance to antimicrobial agents is limited in Patna. For the quality treatment of the patients there was need of reliable and comprehensive data regarding antimicrobial susceptibility patterns of stool isolates.

Most bacterial agents that cause diarrhea in children are

Age of patients (in years)	Total no. patients	Percentage	Sex of patients		
			Sex	Total no. patients	Percentage
01-5	26	23.21			
6-10	52	46.43	Male	70	62.5
11-15	28	25			
16-20	06	5.36	Female	42	37.5

Table-1: Shows Age and Sex distribution of patients with Gastroenteritis's

Bacterial Isolates	No. of Isolates	Percentage
Shigellaspecies	26	23.21
Salmonella species	51	45.43
E. coli	14	12.5
Klebsiella species	3	2.67
Enterobacter	7	6.25
Pseudomonas species	2	1.78
Staphylococcus aureus	9	8.03

Table-2: Shows Bacterial Isolates, isolated in culture

Antimicrobial agent	Shigella Sp. (n= 26) Resistance Rate %		Salmonella species (n=51) Resistance Rate %	
	May 2019-April 2020(No. of isolates) (%)	May 2020-April 2021 (No. of isolates) (%)	May 2019-April 2020(No. of isolates) (%)	May 2020-April 2021 (No. of isolates) (%)
Ampicillin	5(19.23%)	7(26.92%)	4(7.8%)	8(15.68%)
Nalidixic Acid	2(7.69%)	4(15.38%)	5(9.8%)	23(45.09%)
Chloramphenicol	16(61.53%)	21(76.92%)	8(15.68%)	11(21.56%)
Cotrimoxazole	21(80.76%)	20(76.92%)	10(19.6%)	12(23.52%)
Azithromycin	3(11.53%)	5(19.23%)	7(13.72%)	14(27.45%)
Imipenem	2(7.69%)	3(11.53%)	3(5.88%)	5(9.80%)
Tetracycline	3(11.53%)	5(19.23%)	3(5.88%)	5(9.80%)
Ciprofloxacin	1(3.84%)	2(7.69%)	1(1.96%)	2(3.92%)
Ofloxacin	1(3.84%)	2(7.69%)	1(1.96%)	2(3.92%)
Amikacin	3(11.53%)	5(19.23%)	1(1.96%)	2(3.92%)
Ceftriaxone	2(7.69%)	3(11.53%)	1(1.96%)	2(3.92%)
Cefixime	2(7.69%)	4(15.38%)	3(5.88%)	8(15.60)
Ceftazidime	1(3.84%)	2(7.69%)	1(1.96%)	2(3.63%)
Cefotaxime	1(3.84%)	2(7.69%)	1(1.96%)	2(3.63%)
Furazolidone	3(11.53%)	4(15.38%)	2(3.92%)	3(5.88%)

Table-3: Shows comparison of the antimicrobial resistance of Shigella and Salmonella isolates. Resistance to antimicrobial agents increased among most of the pathogens between 2019 to 2021.

Shigella, Salmonella, Escherichia coli, Campylobacter, Yersinia enterocolitica, Clostridium perfringens, Clostridium difficile and Aeromonas[4,8,9].

According to our study, the most common bacterial agents of infectious diarrhea in Patna are Shigella spp. (25.83%) and Salmonella spp. (45.83%). In developing countriesshigella spp. showed very high rates of antibiotic resistance, that are commonly available in their countries.

The present study demonstrated fairly high rates of resistance to Salmonella and shigella spp. From various antibiotics during the 24-month study period. Cefixime and azithromycin resistance among Shigella spp. has steadily increased.

A study by Naik, et al. showed high rates of resistance against Ampicillin, Chloramphenicol and Trimethoprim-sulfamethoxazole[5]. 6% of the S. flexneri isolates was resistant to nalidixic acid. Since 2019 Ampicillin, Amikacin and Chloramphenicol resistance among Salmonella spp. has increased from 7.8% to 15.68%, 1.96% to 3.92% and 15.68% to 21.56% in 2021 respectively. In contrast, there has been no significant change in Tetracycline andTrimethoprim-sulfamethoxazole resistance. This may be due to a lesser usage in comparison with the first group of antibiotics.

Prats. Et. Al. who was studying Salmonellae, found an increase in the rates of resistance to Ampicillin (from 8 to 44%), Tetracycline (from 1 to 42%) Chloramphenicol (from 1.7 to 26%), Trimethoprim-Sulfamethoxazole (from 0.5 to 11%) and Nalidixic acid (from 0.1 to 11%) throughout their 7 years study[4].

Resistance rates among Non-typhoidal Salmonella spp. has been reported by other studies in India and Spain.Quinolones are highly sensitiveantimicrobialin most of the bacterial gastroenteritis and are often recommended as empirical therapy but due to the potential risk of damage to growing cartilage they are not approved for children[6,10].

Resistance to fluoroquinolones has been rarely reported and almost all Shigella isolates are susceptible to them. Our results showed no increased resistance to ciprofloxacin among Shigella and Salmonella isolates. Among Shigella spp., resistance to Nalidixic acid was found to have increased gradually from 7.69% to 15.38%[4].

According to Taneja, et al. resistance to nalidixic acid has increased from 7.4% between 1994 and 1998 to 63.3% between 2000 and 2002[1,7]. This may be due to the widespread, under dose, use of this drug as the first choice for empiric treatment of infectious diarrhea in children.

Determination of antibiotic resistance rates among isolates from adolescents and adultswas not possible in the present studydue to its significant limitations**.** The observed rates may be over estimates an antibiotic use generally tends to decrease with age. Other limitations were the unavailability of information about other variables (e.g., previous antibiotic use, previous hospitalization, otherunderlying disease) that are associated with the isolation of antibiotic resistant bacteria. younger children are more likely to associated with antibiotic resistance than older children to yield resistant strains.

CONCLUSION

Routing surveillance of antimicrobial susceptibility of all classes of clinically used agents is necessary to detect resistance trends in different parts of the world whichhelp in detecting the emergence and trends of newer resistance mechanisms, prompt action taken for infection control and formulating public health guidelines. That type of research also helps in identifying the outbreaks of resistant organisms and the data generated can help in advocating appropriate antibiotic regimens.

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