Original article

Frequency and Antibiotic Sensitivity Pattern of Culture Positive Salmonella Typhi in Children Visiting to RHQ Hospital Gilgit

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ABSTRACT

Background: Typhoid fever, caused by Salmonella enterica serovar typhi, is a common infection that affects multiple body systems. Salmonella is a constantly evolving and adaptable bacterium, so overuse of a particular treatment may eventually lead to the development of resistance. To determine the frequency and antibiotic sensitivity pattern of culture positive salmonella typhi in children visiting to RHQ hospital Gilgit.

Patient and Methods: An observational cross-sectional study was conducted at RHQ Hospital Gilgit from June to August 2022. Through non-probability, consecutive sampling, a total of 150 patients of either gender with ages ranging from 1 month to 12 years and enteric fever symptoms as well as positive blood culture results for Salmonella species were enrolled in this study. In the microbiology lab, the blood culture bottles were incubated for seven days at 37 °C while daily growth indicators were monitored. On the pre-designed proforma, the basic demographic history and Salmonella species' susceptibility patterns were noted. Data was entered and analyzed by SPSS 25.0.

Results: The average age of these patients was 6.63±3.35 years. Among the patients, the majority were male, accounting for 97 individuals (64.6%), while 53 individuals (35.4%) were female. Fever was most common symptoms among patients with highest frequency of 59, followed by body aches (35). Almost 98% of cases were resistant to ciprofloxacin, commonly used as a first-line drug against Salmonella Typhi in Pakistan. Resistance was also very high against ampicillin (92%). The Azithromycin and Imipenem were the only drugs with a sensitivity of more than 90%.

Conclusion: The existence of typhoid fever cases and the increasing resistance of Salmonella strains to ceftriaxone and Ampicillin are causes for serious concern. Meropenem and azithromycin, whether used individually or in combination, proved to be the most effective antibiotics for treatment.

Keywords:
Salmonella Typhi, Enteric fever, antibiotics sensitivity, drug resistance

INTRODUCTION

Typhoid fever, caused by Salmonella enterica serovar typhi, is a common infection that affects multiple body systems. The worldwide annual incidence is about 27 million cases, with a mortality rate of about 1%.[1] Typhoid and paratyphoid infections are prevalent in regions with inadequate access to clean water and sanitation facilities, particularly in South Asia, Southeast Asia, and sub-Saharan Africa. These infections pose a significant health threat and are a leading cause of mortality and morbidity, especially among children in these areas.[2,3]

Antimicrobial resistance (AMR), which threatens our ability to effectively prevent and cure a growing number of diseases caused by bacteria, parasites, viruses, and fungi, has emerged as a significant public health challenge in the twenty-first century. These microorganisms are increasingly developing resistance to over-the-counter drugs. As for bacterial resistance to antibiotics, the problem is very urgent. Bacteria that cause both mild and severe infections have become increasingly resistant to each new antibiotic that comes on the market over the decades. Faced with this worrying fact, we must act immediately to prevent an impending global health crisis.[4]

According to the European Surveillance of Antimicrobial Consumption Network (ESAC-Net) annual report for Europe published in 2012, consumption of antibacterial agents for systemic use in the community was substantial. According to ESAC-Net, the population-weighted average consumption of systemic antibiotics in the hospital sector was 2.0/per 1000 persons in 2012. The beta-lactam/penicillin class was prescribed most frequently in these hospitals and accounted for 29.3% of total systemic antibiotic use.[5] In addition, 35.0% of hospitalized patients were taking antibiotics, according to a 2011 point-in-time prevalence survey of healthcare-associated infections in Europe. In light of this worrying reality, we must act immediately to prevent a disaster in global healthcare.[6]

Conflict of interest: The authors declared no conflict of interest exists.
Citation: Khan Z, Ali M, Bari a. Frequency and Antibiotic Sensitivity Pattern of Culture Positive Salmonella Typhi in Children Visiting to RHQ Hospital Gilgit. J Fatima Jinnah Med Univ. 2023; 17(2):57-60.

DOI: https://doi.org/10.37018/JFJMU/MUN/1200

Misuse of antibiotics is associated with a number of widespread practices, including self-medication and disregard for the recommended course of treatment. Self-administration of antimicrobials is often done in unnecessary, inadequate, and incorrect doses, fostering an environment in which microorganisms can adapt rather than be eliminated. Self-medication with antimicrobials is a common practice worldwide, especially in areas with lax regulatory frameworks where antibiotics are sold as over-the-counter medications. However, it is also observed in some developed countries.[7]

In recent decades, the sensitivity of Salmonella Typhi to antibiotics has changed significantly. Many strains initially responded to first-line drugs such as chloramphenicol, ampicillin and cotrimoxazole and have now developed multidrug resistance (MDR). While susceptibility to third generation cephalosporins and azithromycin persists, resistance to fluoroquinolones is becoming an increasing concern.[8] Salmonella is a constantly evolving and adaptable bacterium, so overuse of a particular treatment may eventually lead to the development of resistance. As a result, healthcare professionals need to be up to date on the latest antibiotic susceptibility profiles. With this knowledge, they are better able to change their prescribing practices, stop the emergence of antibiotic resistance, and limit the unnecessary use of antibiotics, which are often used only as a last resort. Therefore, the present study was conducted to determine the frequency and antibiotic sensitivity pattern of culture positive salmonella typhi in children visiting to RHQ hospital Gilgit.

PATIENTS AND METHOD

An observational cross-sectional study was conducted at RHQ Hospital Gilgit from June to August 2022. Through non-probability, consecutive sampling, a total of 150 patients of either gender with ages ranging from 1 month to 12 years and enteric fever symptoms as well as positive blood culture results for Salmonella species were enrolled in this study.

Medical staff took blood samples in the brain heart infusion broth and sent them to the lab for sensitivity and culture testing. In the microbiology lab, the blood culture bottles were incubated for seven days at 37 °C while daily growth indicators were monitored.

Samples were subculture on blood and MacConkey agar (Oxoid) plates and incubated at 37°C for 24 hours after 18–24 hours of incubation. On the second day, the plates were checked for bacterial growth. The each individual colony was chosen, and its cultural traits were investigated. Gram's staining and the biochemical test/API 20E (bioMerieux) were carried out to check for growth. On Mueller Hinton agar (Oxoid), antibiotic sensitivity testing were conducted using the Kirby Bauer disc diffusion method. Salmonella bacteria classified as MDR and XDR. The following antibiotics were tested: Ampicillin, Azithromycin, Meropenem, ciprofloxacin, trimethoprim/sulfamethoxazole.[9]

On the pre-designed proforma, the basic demographic history and Salmonella species' susceptibility patterns were noted. Data was entered and analyzed by SPSS 25.0.

RESULTS

The current study consisted of a total of 150 patients. The average age of these patients was 6.63 years with a standard deviation of 3.35 years. Among the patients, the majority were male, accounting for 97 individuals (64.6%), while 53 individuals (35.4%) were female. Additionally, 85 patients (56.5%) belonged to rural areas, while 65 patients (43.3%) resided in urban areas.

Table 1: Demographic Information of Patients

Variables	Mean + SD or f (%)
Age (in years)	6.63+3.35
Gender	
Male	97(64.6%)
Female	53(35.4%)
Residential Area	
Rural	85(56.5%)
Urban	65(43.3%)

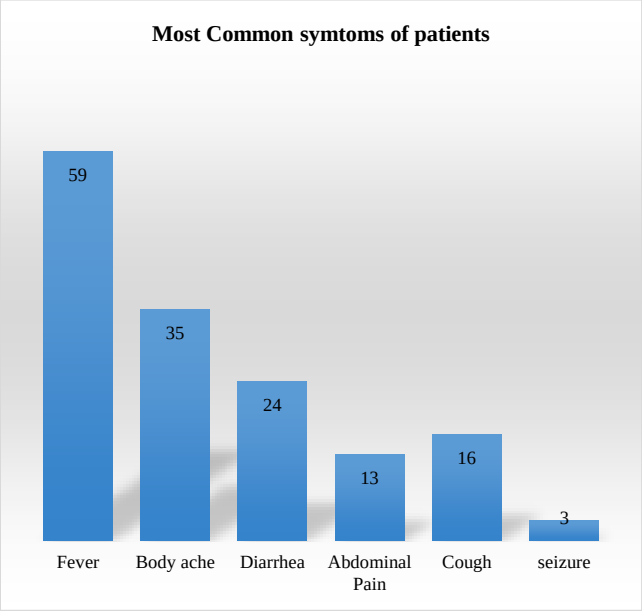

Figure 1: Common Symptoms of Patients

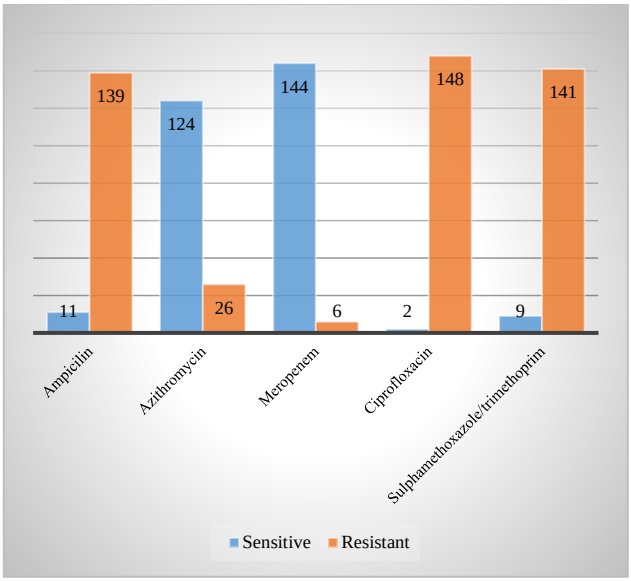

Figure 2: Antibiotic Sensitivity Pattern

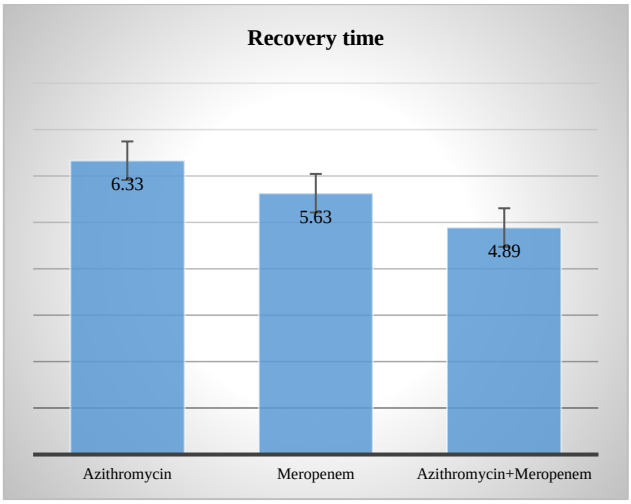

Figure 3: Recovery time in patients according to treatment

Figure 1 represents the symptoms reported by patient. Fever was most common symptoms among patients with highest frequency of 59, followed by body aches (35), diarrhea (24), cough (16), abdominal pain(13) and seizure (3). (Figure 1)

The majority of the samples indicated that Ampicillin was the most commonly resistant drug, with 139 cases showing resistance. Following Ampicillin, Ciprofloxacin was the second most common drug with resistance reported in 148 cases, and Sulphamethoxazole/trimethoprim exhibited resistance in 141 cases. On the other hand, Azithromycin was found to be the most commonly sensitive drug in typhoid fever, showing sensitivity in 124 cases, while Meropenem was the second most sensitive drug with 144 cases demonstrating sensitivity. (Figure 2)

According to the treatment plan and as depicted in the figure, the study's findings indicated that the combination therapy of Azithromycin and Meropenem was the most effective, with a mean recovery time of 4.89 days. Following this, Meropenem alone had a mean recovery time of 5.63 days, and Azithromycin alone had a slightly longer mean recovery time of 6.33 days. (Figure 3)

DISCUSSION

The incidence of drug resistance was reported in our study was very high. Almost 98% of cases were resistant to ciprofloxacin, commonly used as a first-line drug against Salmonella Typhi in Pakistan. Resistance was also very high against ampicillin (92%). The Azithromycin and Imipenem were the only drugs with a sensitivity of more than 90%.

In our study, ciprofloxacin resistance was extremely common (98% of patients had ciprofloxacin resistance). 91.7% of typhoid fever patients in a research were resistant to quinolones, which was supported by other studies from Pakistan.[10] For more than 20 years, fluoroquinolones were the go-to medication for treating enteric fever, but large levels of drug resistance to these medications are now being reported from all over the world, particularly from South Asia.[11] This bolsters our conclusions as well.

Salmonella typhi is very responsive to ceftriaxone, ofloxacin, and chloramphenicol, and is least sensitive to amoxicillin and ciprofloxacin, according to a study done at the KNTI Children Hospital in Nepal.[12]

The sensitivity pattern found in our investigation is partially supported by this study. Another investigation at the Nepal Medical College Teaching Hospital, which is partially consistent with the present study, found that S. typhi is extremely responsive to the antibiotics ciprofloxacin and amikacin.[13]

One of the few available treatments for these superbugs is azithromycin. High susceptibility of 92% and 92.6% was found in two separate Indian cities, according to a study by Misra R and colleagues.[14] A further investigation by Divyashree et al. revealed 93.6% azithromycin susceptibility.[15]

Another study found that azithromycin was sensitive in 96.7% of instances while meropenem was sensitive in 100% of cases. Enteric fever caused by MDR and XDR is quite dangerous. Azithromycin continues to be the most effective oral antibiotic in such cases.[16]

CONCLUSION

The existence of typhoid fever cases and the increasing resistance of Salmonella strains to ceftriaxone and Ampicillin are causes for serious concern. Meropenem and azithromycin, whether used individually or in combination, proved to be the most effective antibiotics for treatment. S. typhi remains the primary culprit for enteric fever in our region, but the emergence of strains that are more susceptible to antibiotics could potentially assist clinicians in managing this disease more effectively and reducing its impact on morbidity.

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