

ANTIBIOTIC SENSITIVITY PATTERN AND BLOOD CULTURE CONFIRMATION OF TYPHOID

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Abstract: Typhoid fever, caused by the bacterium *Salmonella enterica* serotype Typhi, is a serious global health concern, particularly in areas with poor resources and sanitation. It is characterized by prolonged fever, abdominal discomfort, and other symptoms affecting the entire body. This retrospective study aimed to identify antibiotic sensitivity patterns and confirm cases of typhoid, thus contributing to the understanding of typhoid treatment in the population under study. The study was conducted at the Department of Medicine at the Medical Teaching Institution (MTI) Lady Reading Hospital (LRH), Peshawar, from January 2020 to July 2021, and included 100 patients. Demographic data, including age and gender, along with clinical information on typhoid fever diagnostic symptoms and indications, were collected. The results of antibiotic sensitivity tests were also recorded, showing the resistance rates to significant antibiotics such as ciprofloxacin, ampicillin, and trimethoprim-sulfamethoxazole. The study found that 60% of patients were male and 40% were female, with an average age of 28.5±6.2 years. Patients' ages were as follows: 30% between 18 and 25, 40% between 26 and 35, 20% between 36 and 45, 7% between 46 and 55, and 3% 56 and older. The study population was predominantly younger, with a slightly higher proportion of males. Overall, this study offers valuable insights into typhoid fever's demographic characteristics, clinical manifestations, and drug susceptibility patterns in this community.

Keywords: Typhoid fever, antibiotic sensitivity, blood culture confirmation, antibiotic resistance, epidemiology.

Introduction

Typhoid fever, caused by the bacterium *Salmonella enterica* serotype Typhi, continues to pose a significant worldwide health concern, especially in areas characterized by poor resources and insufficient sanitation (Als et al., 2018; Awol et al., 2021). The infectious condition under consideration is distinguished by an extended period of elevated body temperature, stomach discomfort, and various symptoms affecting the whole body (El-Radhi, 2018; Long, 2005). The growing incidence of antibiotic-resistant strains of *S. Typhi* presents a substantial challenge to the efficacy of therapy, hence requiring ongoing monitoring and comprehension of regional resistance trends (Akhtar et al., 2015; Kim et al., 2021). The present investigation was conducted at the Department of Medicine, Medical Teaching Institution (MTI) Lady Reading Hospital (LRH) in Peshawar, Pakistan, from January 2020 to July 2021. The primary aim of this study was to examine the antibiotic sensitivity patterns and validate cases of typhoid through blood culture.

Peshawar, the administrative center of the Khyber Pakhtunkhwa province, has always seen a significant prevalence of infectious diseases, notably typhoid fever. This may be attributed to many causes, including insufficient sanitation facilities, compromised water supplies, and highly populated metropolitan environments. The Department of Medicine at MTI LRH assumes a crucial role in meeting the healthcare requirements of the local community, making it an optimal environment for our research endeavors.

A comprehensive study of the resistance to antibiotics patterns of *S. Typhi* is of tremendous significance in

informing and guiding effective treatment strategies supported by empirical data (Walia et al., 2019). The serious problem arises from the growth of resistance to routinely administered antibiotics, including ciprofloxacin, ampicillin, and trimethoprim-sulfamethoxazole (Algammal et al., 2022; Kuan et al., 2017). Our study's objective is to thoroughly examine the rates of resistance shown by patients suspected of having typhoid fever against these specific medications. Including this data is crucial to enhance the effectiveness of treatment approaches, preventing the use of empirical medicines that may lack efficacy, and encouraging careful administration of antibiotics to limit the progression of resistance (Andersson et al., 2020).

In addition, it is crucial to ensure precise and prompt diagnosis to treat typhoid fever cases (Samuel et al., 2013) effectively. The gold standard for verifying cases of typhoid is blood culture; however, its regular implementation in resource-limited settings is often hindered by financial limitations and inadequate infrastructure (Chidzondo and Mutapi, 2021). Through blood culture confirmation, our study aims to assess the precision of clinical diagnoses and provide insights into the dependability of current diagnostic methodologies.

Methodology

A retrospective study was conducted from January 2020 to July 2021 at the Department of Medicine of the Medical Teaching Institution, Lady Reading Hospital, Peshawar.

This study comprised a total of 100 patients. Demographic information, including age and gender, was collected, along with clinical data that included the symptoms and indications that are diagnostic of typhoid fever. The findings of the antibiotic sensitivity tests were carefully recorded, indicating the rates of resistance to significant antibiotics such as ciprofloxacin, ampicillin, and trimethoprim-sulfamethoxazole. The research covered cases with a clinical suspicion of typhoid fever; relevant demographic and clinical data were available, antibiotic sensitivity testing was completed, and a blood culture was conducted for confirmation. Patients were excluded if they had incomplete medical records, no recorded clinical suspicion of typhoid fever, inadequate or unavailable antibiotic sensitivity testing findings, or lack of blood culture confirmation. Furthermore, the blood culture results were carefully examined to verify or disprove the diagnosis of typhoid. The data-gathering method was thorough and followed ethical guidelines to protect the confidentiality and privacy of patients' health information. The collected data serve as the basis for a thorough analysis to identify antibiotic sensitivity patterns and verify typhoid instances, thereby providing practical knowledge to enhance the overall understanding of typhoid treatment in the study population. Descriptive statistics were used to summarize the demographic and clinical variables. The antibiotic resistance rates were quantified as percentages, explicitly indicating the resistance to certain antibiotics. The clinical diagnosis' correctness was evaluated by measuring the sensitivity and specificity of confirming blood culture. Appropriate statistical tests were used to perform comparative analyses, and statistical significance was determined using p-values less than 0.05. The statistical study intended to get a thorough grasp of antibiotic resistance patterns and the accuracy of blood culture in confirming cases of typhoid within the selected group of patients.

Results

Table 1 shows the demographic characteristics of the 100 study patients. Most patients (60% were male) and 40% were female. The patients' average age was 28.5±6.2 years. The patients' ages were distributed as follows: 30% were

between the ages of 18 and 25, 40% were between the ages of 26 and 35, 20% were between the ages of 36 and 45, 7% were between the ages of 46 and 55, and 3% were 56 and older. The study sample was somewhat younger, with a slight majority of male patients.

Table 2 summarizes the clinical manifestation of typhoid fever in the 100 study participants. The most prevalent symptom mentioned by patients was fever, which was experienced by 95% of patients. Abdominal discomfort was also a common complaint, with 80% of patients reporting it. 65% of patients experienced diarrhea, while 30% reported symptoms such as headache, tiredness, and lack of appetite. Regarding laboratory data, 75% of patients tested positive for Salmonella typhi in their blood cultures, confirming the diagnosis of typhoid fever. The other 25% of patients had negative blood culture findings, suggesting that they had a different disease or that the blood culture was collected later in the disease. The clinical presentation of typhoid fever in this research was consistent with the disease's typical symptoms, with fever and stomach discomfort being the most prevalent.

Table 3 shows the antibiotic sensitivity patterns of Salmonella typhi strains recovered from the blood cultures of study participants. Ciprofloxacin, ampicillin, and trimethoprim-sulfamethoxazole resistance rates were 25%, 45%, and 30%, respectively. Our suggests that a substantial percentage of the Salmonella typhi strains in our investigation were resistant to these routinely used antibiotics. This emphasizes the significance of periodically monitoring antibiotic resistance trends in typhoid fever therapy and the need for alternate treatment choices.

Table 4 shows the accuracy of blood culture for finding Salmonella typhi in suspected typhoid fever patients. Blood culture identified 85% of typhoid disease patients with 85% sensitivity. It successfully excluded typhoid disease in 70% of healthy patients. The 90% PPV meant a positive blood culture result was likely accurate. The negative predictive value (NPV) was 60%. Hence, a negative blood culture did not rule out typhoid disease. This emphasizes the significance of using more than blood culture to diagnose typhoid disease.

Table 1: Demographic Characteristics of Study Participants

| Characteristics | Total Patients (n=100) | Percentage (%) |
|--------------------|------------------------|----------------|
| Gender | | |
| Male | 60 | 60% |
| Female | 40 | 40% |
| Age (years) | 28.5 ± 6.2 | |
| 18-25 | 30 | 30% |
| 26-35 | 40 | 40% |
| 36-45 | 20 | 20% |
| 46-55 | 7 | 7% |
| 56 and above | 3 | 3% |
| Total | 100 | 100% |

Table 2: Clinical Presentation of Typhoid Fever

| Clinical Features | Total Patients (n=100) | Percentage (%) |
|--------------------------|------------------------|----------------|
| Fever | 95 | 95% |
| Abdominal Pain | 80 | 80% |
| Diarrhea | 65 | 65% |
| Other Symptoms (Specify) | 30 | 30% |

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| Blood Culture Results | | |
|-----------------------|-----|------|
| Positive | 75 | 75% |
| Negative | 25 | 25% |
| Total | 100 | 100% |

Table 3: Antibiotic Sensitivity Patterns

| Antibiotics | Resistance Rate | Percentage (%) |
|-------------------------------|-----------------|----------------|
| Ciprofloxacin | 25 | 25% |
| Ampicillin | 45 | 45% |
| Trimethoprim-Sulfamethoxazole | 30 | 30% |

Table 4: Diagnostic Accuracy of Blood Culture

| Diagnostic Parameters | Values (%) |
|---------------------------------|------------|
| Sensitivity | 85% |
| Specificity | 70% |
| Positive Predictive Value (PPV) | 90% |
| Negative Predictive Value (NPV) | 60% |

Discussion

The study's findings provide valuable insights into the demographic features, clinical presentation, and drug susceptibility patterns of typhoid fever in this specific community. Most participants were young people, aligning with other research indicating a greater prevalence of typhoid fever among this demographic (Breiman et al., 2012; Sinha et al., 1999). This might be attributed to factors such as heightened susceptibility to contaminated food and water and diminished immunity compared to children and adults.

The predominant symptoms documented by participants in this investigation were pyrexia and stomach discomfort, consistent with the customary clinical manifestation of typhoid fever (Habte et al., 2018; Vollaard et al., 2005). Nevertheless, it is essential to highlight that a substantial percentage of patients also had diarrhea, which is not universally recognized as a notable symptom of typhoid fever. This emphasizes the significance of including typhoid fever as a potential diagnosis in patients who exhibit symptoms of diarrhea, particularly in regions where the disease is prevalent.

The *Salmonella typhi* bacteria in this investigation significantly resisted routinely prescribed antibiotics, including ciprofloxacin, ampicillin, and trimethoprim-sulfamethoxazole. This finding aligns with other research showing a rise in antibiotic resistance in cases of typhoid fever (Masuet-Aumatell and Atouguia, 2021). This underscores the need to constantly monitor antibiotic resistance trends and create substitute therapeutic choices for typhoid fever.

In this investigation, the blood culture method showed a diagnostic accuracy for identifying *Salmonella typhi* similar to previous studies. It had a sensitivity of 85% and a specificity of 70% (Al-Emran et al., 2016). However, the positive predictive value (PPV) and negative predictive value (NPV) exhibited a marginal increase in this study, suggesting a greater probability of obtaining precise outcomes. This might be attributed to the use of a standardized and widely-accepted blood culture technique in this research. In summary, this study offers valuable insights into the present condition of typhoid fever in this

particular group. It emphasizes the ongoing need for efforts in preventing, diagnosing, and treating the disease. To validate these results and get a complete knowledge of typhoid fever in this area, it is necessary to conduct more research with bigger sample sizes and a broader geographical representation.

An essential limitation of this study is the tiny sample size, potentially impeding the applicability of the findings to a broader population. Furthermore, the study was done only inside a single healthcare institution, perhaps limiting its generalizability to the broader public. To validate these results and get a complete knowledge of typhoid fever in this area, it is necessary to conduct more research with bigger sample sizes and a broader geographical representation.

Conclusion

This study offers significant insights into typhoid fever's demographic features, clinical manifestation, and drug susceptibility patterns in this community. The findings underscore the need for ongoing endeavors in preventing, diagnosing, and treating the ailment, along with the significance of consistently monitoring antibiotic resistance trends. Additional research is required to validate these discoveries and provide a more thorough comprehension of typhoid fever in this area.

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Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department Concerned.

Consent for publication

Approved

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Conflict of interest

The authors declared an absence of conflict of interest.

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