

RESISTANCE PATTERN OF EXTENDED DRUG RESISTANT SALMONELLA TYPHI IN CHILDREN

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Abstract To determine the frequency of antibiotic resistance of extended drug-resistant *Salmonella typhi* in children. Cross-sectional observational study was conducted at Pediatric B Unit, Hayatabad Medical Complex, Peshawar, from 1st April 2021 to 30th June 2022. Approval from the institutional ethical committee was obtained. Using nonprobability consecutive sampling technique, this study was conducted on 104 pediatric patients admitted to Children B Unit with blood culture-proven enteric fever. Data was collected from blood cultures and sensitivity reports from the microbiology section of our hospital laboratory. This study was conducted on 32 female and 72 male pediatric in-patients with blood culture-proven enteric fever caused by *Salmonella typhi*. Resistance to Azithromycin was 43.26%, Meropenem 17.30%, Polymixin 13.46%, Colistin 31.73%, Tigecycline, 01.92%, Imipenem 04.80% *Salmonella typhi* demonstrated high levels of resistance to commonly used antibiotics.

Keywords: Antibiotic resistance, *Salmonella typhi*, children, enteric fever

Introduction

Enteric fever is considered a significant health issue in developing countries where risk factors for contracting this infectious disease, like poverty, overpopulation, lack of clean drinking water and sanitation, and improper disposal of human waste, are prevalent. Moreover, indiscriminate and irrational use of antimicrobial agents is rampant. This has resulted in widespread resistance to various antimicrobial treatments for enteric fever. Reports of the emergence of extensive antibiotic resistance among isolates of *Salmonella typhi* from all over Pakistan are appearing in literature (M. Khan et al., 2022). Pediatric age group is also affected by drug-resistant *Salmonella typhi* (S. Ahmad et al., 2020; F. Z. Khan, Baig, Zameer, & Sharafat, 2018).

This increasing spread of resistance among pathogenic strains of *Salmonella typhi* has resulted in the loss of affordable antibiotic options for the treatment of enteric fever, compelling clinicians to use costly antibiotics like azithromycin and carbapenems (Memon, Ahmed, & Iqbal, 2020; Umair & Siddiqui, 2020). Indiscriminate use of these relatively newer agents may result in resistance. This may lead to complete treatment failure if the trend of increasing resistance is not stopped (Hussain et al., 2019). This fact necessitates surveillance of antibiotic resistance of *Salmonella typhi* by using blood culture to detect resistance and choose the effective antibiotics (Anjum et al., 2021; Hameed et al., 2019). Antibiotic stewardship and selective use

of antibiotics, according to sensitivity report, is essential to deal with this challenge (Chaudhry, 2022; Nusrat et al., 2022). This study was undertaken to determine the resistance pattern of *Salmonella typhi* strains causing enteric fever in our patients.

Materials and methods

Material & Methods: Approval from the institutional ethical committee was obtained and using non probability consecutive sampling technique, this study was conducted on 104 pediatric patients admitted to Children B Unit, Hayatabad Medical Complex Peshawar. Inclusion criteria were pediatric patients with clinical features consistent with enteric fever and isolation of *Salmonella typhi* from blood culture. Exclusion criteria were clinical features of acute febrile illnesses like malaria, urinary tract infection, meningitis, etc. Data was collected from blood culture and sensitivity reports from the microbiology section of our hospital laboratory using a proforma prepared for data collection. Results were entered in Microsoft Excel 2010 spreadsheet and analyzed for calculating percentages. Results were presented in tables.

Results: This study was conducted on 32 female and 72 male pediatric in-patients with blood culture-proven enteric fever caused by *Salmonella typhi*. Resistance to azithromycin was 43.26%, meropenem 17.30%, polymixin 13.46%, colistin 31.73%, tigecycline, 01.92%, imipenem 04.80%

Table 1: Antibiotic Resistance Pattern of Salmonella Typhi

S No	Antibiotic	Resistant	Percentage
1	azithromycin	45	43.26%
2	meropenem	18	17.30%
3	polymixin	14	13.46%
4	colistin	33	31.73%
5	tigecycline	02	01.92%
6	imipenem	05	04.80%

Discussion

Our study shows 45 isolates out of 104 (43.26%) resistant to azithromycin. Literature reporting rising resistance of Salmonella typhi against conventional antibiotics and newer agents like azithromycin, carbapenems, and tigecycline is a genuinely alarming phenomenon (Butt et al., 2022). Salmonella isolates carrying mutations that confers azithromycin resistance have been reported (Iqbal et al., 2020). A study by Ahmad reported 55.81% resistance to azithromycin (A. Ahmad et al., 2021). 93 out of 323 (28.7%) isolates were resistant to azithromycin studied by Shaikh and colleagues (Shaikh, Shaikh, & Tahir, 2019). A study from Islamabad in 322 patients found 204 (63.4%) isolates azithromycin resistant (Umair & Siddiqui, 2020). A study from Rawalpindi showed 62 out of 108 (57.4%) isolates resistant to azithromycin. The findings of these studies are supporting one another and may be pointing to the presence and progress of resistance to azithromycin (Menz et al., 2021).

This study detected resistance to meropenem in 18 (17.30%). 47.7% isolates were resistant to meropenem in a study by Shah SA et al. (Shah et al., 2020) Out of 108 isolates 44 (40.7%) were reported resistant to meropenem by Shah SA and colleagues (Browne et al., 2020). These findings indicate a grave situation if such a high level of resistance spread because it will make Salmonella typhi infection incurable.

Our study detected 05/104 (04.80%) Salmonella typhi isolates showing resistance to imipenem. In comparison, Amber reported 1.8% resistance (Amber, Fatima, Qurat-ul-ain Khalid, Khan, & Zulfqar, 2021). Other studies had reported no resistance in their patients (Malik & Ahmed, 2016; Yasin et al., 2022). Our study showed resistance of 31.73% to colistin, 13.46 % to polymixin B, and 1.92% to tigecycline. Local data showing recent trends in resistance to polymixins and tigecycline almost non-existent.

Conclusions

Salmonella typhi demonstrated high levels of resistance to commonly used antibiotics. This indicates a strong need for judicious antibiotic use based on culture and sensitivity reports of the isolated strain of Salmonella typhi.

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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

Not applicable

Consent for publication

Not applicable

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Not applicable

Conflict of Interest

Regarding conflicts of interest, the authors state that their research was carried out independently without any affiliations or financial ties that could raise concerns about biases.



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