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Typhoid Fever in Asia: Prevalence, Transmission, and Control Strategies in Low-Resource Regions

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ABSTRACT

Enteric fever, referred to as typhoid fever, is an overwhelming multi-systemic infection with major health consequences. It is caused by *Salmonella enterica* serotype Typhi, a member of the Enterobacteriaceae family, which can lead to various gastrointestinal infections. If left untreated, the disease can lead to severe complications such as delirium, intestinal hemorrhage, bowel perforation, and even death within a month of infection. Typhoid fever is widespread across the world, especially in areas with poor sanitation and water infrastructure. This bacterial bloodstream illness is still one of the most common in Asia due to inadequate sanitation and contaminated water sources. This infectious disease spreads by house flies and other vectors through contaminated food, drink, and water. The prevalence of typhoid fever in China, Japan, Mongolia, Korea, Taiwan, India, Pakistan, and Bangladesh was determined by searching online databases. According to epidemiological data, typhoid fever is more prevalent in developing countries like Bangladesh, India, and Pakistan where access to clean water and proper sanitation are major issues. In contrast, Asian nations like China, Japan, Mongolia, and Taiwan report significantly lower incidence rates. Over recent years, this infectious pathogen has demonstrated increasing antibiotic resistance, making prevention a critical strategy for reducing disease burden. Effective prevention and control require high-impact interventions targeting healthcare infrastructure, alongside improvement in sanitation, access to safe water, and planned urbanization.
Keywords: Typhoid, Prevalence, Para typhi, Enteric Fever, Asian countries

INTRODUCTION

Infection with the *Salmonella enterica serovar Typhi* bacteria causes typhoid fever, with associated cases resulting from *serovars Paratyphi* A, B, and C.[1] It is a life-threatening disease transmitted mainly by the fecal-oral route through contaminated food or water. Whereas endemic enteric fever (EF) has notably decreased in high-income nations as a result of better sanitation and water quality, it continues to be one of the leading public health problems in numerous low-income countries, both among local residents and foreign visitors. While worldwide incidence is declining, a number of challenges remain: inconsistent clinical presentations, development of *Salmonella Paratyphi* as a predominant pathogen in certain areas, limitations in initial diagnostic techniques, and escalating antibiotic resistance. In developed nations, travel-associated cases currently form the most prevalent presentation of EF.[2]

EPIDEMIOLOGY

Global surveillance reports in 2017 recorded about 14 million enteric fever (typhoid and paratyphoid fever) cases globally, with an estimated 136,000 deaths. The disease burden was unevenly distributed, and over 80% of cases were seen in South and Southeast Asia, and significant transmission was also observed in sub-Saharan Africa.[2] The COVID-19 pandemic had a profound effect on typhoid fever surveillance and management in Pakistan. After the initial cases of COVID-19 in 2020, the priority in public health changed drastically, thus impacting typhoid control programs. Karachi surveillance data indicated a worrying increase in extensively drug-resistant (XDR) typhoid cases, with 14,360 cases reported between January 2017 and June 2021.[1]

Nevertheless, documented cases fell dramatically to 864 from June 2021 through August 2021, and just 52 new XDR cases were reported in the week up to August 14, 2021.[2] This decline is most probably due to decreased typhoid surveillance capacity during the pandemic and not a real epidemiological trend, as resources were taken away from COVID-19 response operations.[1]

TRANSMISSION

Contaminated water that is consumed at home or used for agriculture is a well-documented mode of transmission of *Salmonella Typhi* and *Salmonella Paratyphi* A.[3] Contaminated food and water are the principal modes of transmission of typhoid fever in low-income countries and cause a high burden of disease. The key risk factors include poverty, crowding, inadequate WASH infrastructure, unhygienic food handling, and the consumption of street-vended foods. Epidemic outbreaks tend to occur in times of arid conditions as small water sources get contaminated. Agricultural processes such as wastewater irrigation have been found to increase the transmission rate, as evidenced by the trend of typhoid cases.[2]

SIGNS & SYMPTOMS

Fever, belly discomfort, nausea, vomiting, myalgias, and arthralgia are all signs of *Salmonella Typhi* and *Salmonella Paratyphi* infection. Diarrhea affects newborns five times more than older kids or adults.[4] Even though constipation can occur. Untreated sufferers might additionally broaden typhoid masks with a light look and disorientation, in addition to a stepladder fever pattern with escalating temperatures over time. Classic signs encompass relative bradycardia and rose patches.[5] Complications along with gastrointestinal bleeding are more prevalent in younger kids who have been ill for several weeks.[6]

CLINICAL PRESENTATION

Typhoid fever has varied clinical presentations ranging from mild illness with low-grade fever to severe systemic infection. After ingestion of the bacteria, a latent asymptomatic bacteremia is followed by development of the symptoms. Incubation is usually 7-14 days but can be 3-60 days based on bacterial load . Sustained fever, malaise, loss of appetite, headache, arthralgia, myalgia, nausea, abdominal cramps, and dry cough are common symptoms. In such severe cases, life-threatening conditions like intestinal perforation, gastrointestinal bleeding, and encephalopathy may develop. Asymptomatic fecal shedding of the bacterium usually precedes clinical manifestations by a few days and thus allows for transmission. Clinical presentation depends on host factors, size of inoculum, and virulence of bacteria, with drug-resistant strains more frequently associated with more severe disease.[7]

DIAGNOSIS

Blood culture is still the gold standard for diagnosing enteric fever. Though bone marrow cultures have a higher sensitivity (80–96%), their invasiveness restricts their common useThe third week of the disease may have a positive stool and rectal swab culture.[8] Although the World Health Organization (WHO) recommends typhoid vaccines for prevention of endemic disease and outbreaks, their implementation is not consistent across many areas. Cost-effectiveness analyses and transmission models are highly informative for vaccine deployment strategy, especially when integrated with other control interventions.[9]

PREVALENCE IN ASIAN COUNTRIES

Typhoid fever imposes a significant financial burden in low- and middle-income countries (LMICs). It accounts for 110,000 deaths and 9 million disease cases annually worldwide, with a disproportionate impact on low- and middle-income nations in Asia and Africa. To significantly reduce the burden of typhoid, the World Health Organization (WHO) recommended in 2018 that typhoid conjugate vaccines (TCV) be used in endemic typhoid countries with a high prevalence of drug-resistant typhoid. With support from Gavi, the Vaccine Alliance, five nations (Liberia, Malawi, Nepal, Pakistan, and Zimbabwe) have incorporated TCV into their regular vaccination regimens by the end of 2023. TCV was also added to Samoa's national immunization program. Three other nations; Zimbabwe, Pakistan, and Fiji also utilized the vaccine to combat epidemics. In order to direct the disease control strategy, it is critically important to comprehend the economic burden, or cost of illness, associated with typhoid fever. [8] In 2014, the World Health Organization recorded 21 million cases of typhoid fever and 200,000 typhoid-associated deaths globally. There were about sixteen million instances of typhoid fever globally in 2000, with 200,000 fatalities, 93% of which came about in Asiannations. Typhoid fever is not unusual in impoverished international locations worldwide, even though it is the maximum standard in Asia. [9]

1. CHINA

Over the last 12 years, there has been a consistent decline in the overall incidence of typhoid/paratyphoid fever in China. The temporal and spatial distribution of typhoid/paratyphoid fever can be influenced by both socioeconomic and meteorological factors. Improving the economic situation could help prevent and treat these fevers, especially in areas where the disease is more common.[10] Typhoid and paratyphoid fever had an incidence charge in 2015, but typically had excessive incidence. There is transregional transmission among elevated states, which may contribute to the the formation of clusters in those areas.[11]

2. JAPAN

The prevalence of typhoid fever changed to 3% primarily based totally on blood and stool tradition diagnosis, and 33% primarily based totally on the Widal check assessment. The sub-organization research found that 2% of febrile patients had typhoid fever, compared to 6% of typhoid-suspected cases. The stool tradition check yielded a result of 4% *Salmonella Typhi* infection, compared to 2% for the blood tradition check.[12]

3. MONGOLIA

In 2015, the whole population of LMICs stood at approximately 6 billion. The anticipated wide variety of typhoid instances within 12 months in all LMICs is eight million. Roughly 40% (or 7.2 million) of all instances are found in Sub-Saharan Africa, according to available literature.

4. KOREA

Six individuals were identified with typhoid fever on Jeju Island in June 2017. Eight instances of typhoid occurred in July and August,t that year. Between the nineteenth and twenty-seventh of July, 5 of the sufferers traveled to northwest India. The first example was suggested on July 22nd, and it was followed by fever, chills, diarrhea, headache, and sweating. The second case was recorded on July 28, and 3 passengers had been identified with typhoid on August 18.[14]

5. TAIWAN

Taiwan has quite low prevalence rate, with only a limited number of documented cases in the preceding decades. A larger variety of the mentioned cases have been delivered from endemic areas. According to the Taiwan Centers for Disease Control, indigenous instances have been relatively rare, accounting for 330 (58.1%) of 568 documented instances between 2001 and 2014.[15]

6. INDIA

In 2016, a scientific assessment of the weight of typhoid fever in India assessed the superiority of laboratory-showed typhoid and paratyphoid in sufferers with fever in the course of all investigations at the health center to be 9.7% (95% CI: 5.7-16.0%) and 0.9% (0.5-1.7%), respectively. A multivariate meta-regression version of this overall looks at a pivotal drop in typhoid prevalence in recent years.[16]

7. PAKISTAN

According to estimates from Pakistan's health officials, 22,354 cases of typhoid fever were reported between 2016 and 2020; and 15,717 were drug-resistant cases from various regions of Sindh that were prevalent. The incidence rate from typhoid fever is calculated using these methods; the rate is around 15.5/1,000. The XDR strain of typhoid fever exhibits a high level of drug resistance or substantial drug resistance. Culture tests, serological testing, nucleic acid assays, protein markers, and biomarkers are all used in the diagnosis of typhoid fever.[17] In Pakistan, blood cultures and serological tests, such as Widal tests, are commonly employed for diagnosis; however, they often yield unacceptably high rates of inaccurate false negative and false positive findings. From January to December 2013, a study was performed at Kohat University of Science and Technology in Kohat, Pakistan. For blood samples from ninety-six individuals, the polymerase chain reaction (PCR) assay was in comparison to the Widal test and blood culture. As a negative control, the blood of 25 wholesome contributors was received for this investigation. The Widal test (26%) and blood culture (14.5%) had the best detection rate (64.5%). Of the 82 (85.4%) samples that have been determined to be negative for blood culture, 48 (58.5%) have been correctly detected via means of PCR, and 11 (13.4%) have been advantageous for the Widal check.[18] Females in the district of Bahawalnagar (Pakistan) had a higher prevalence of typhoid fever. A concerning proportion (54.07%) of confirmed cases of typhoid fever among the population were also discovered to have consumed water from the nearby water-filtration plants in the area under investigation.[19] The latest reviews recommend that about 21 million individuals suffer from typhoid every year, resulting in 161,000 deaths. People in Pakistan's Punjab and Sindh provinces are declared to be at the most threat to suffer from typhoid, out of sixteen Asian nations wherein typhoid is common.[20] The survey was carried out at different public and personal area hospitals in the Gujarat district, Punjab, Pakistan from May 2015 to June 2016. Approximately one hundred forty patients were seen at Aziz Teaching Hospital Bhati, Bhimber Road, Gujarat. Sixty sufferers have been treated or provided care from Gujarat Hospital, Bhimber Road, Gujarat. Other hospitals named Doctors' Hospital, Jail Chow, Gujarat, City Hospital, Jail Chow, Gujarat, and Ikram Hospital, Bhimber Road, Gujarat with approximately 60, 73, 54 and 55 patients respectively participated in the look.A study of 382 typhoid patients treated at specialized public and private hospitals in Gujarat district found no notable gender difference 47.38% were male and 52.62% were female.

Age susceptibility to disease or age distribution among 382 sick individuals or individuals with disease, 32 patients (8.46%) had typhoid between one and 10 years old. Similarly, a hundred and sixty sufferers were observed to be of high quality within the 21-30 age group, displaying an incidence of 42.32%, the best of all age groups. Only 25 (6.61%) people with disease had observed high-quality typhoid fever within the age organization 41-50 at the same time while 23 (6.084%) fell inside the age organization 50 and older.[21] A look carried out in 2003 said that waterborne illnesses killed 250,000 individuals every 12 months in Pakistan, of which typhoid was the leading cause. According to a 2013 study at children admitted in pediatric in Quetta, 18.6% of individuals with disease have been seropositive for typhoid fever, and a 2006 Karachi look at the seroprevalence of typhoid fever of 710 /a hundred 1000 At the same time, blood tradition is 170/a hundred,000. Islamabad is the capital of Pakistan and has the best literacy rate in Pakistan at 88% better among different towns in Pakistan. [9]

8. BANGLADESH

A study conducted in Bangladesh in 2001 showed that typhoid fever was the most prevalent among febrile diseases, accounting for about 72.7%. Another 2010 study reported 88% of cases were of typhoid in children in semi-urban areas of Bangladesh.[9]

Typhoid fever is mostly caused by *Salmonella Typhi*, and Bangladesh is a major contributor to this worldwide issue. This results from Bangladesh's poor standards for hygiene, healthcare, and the overuse and unsuitable use of antibiotics.[22] Typhoid fever's causative agent, *Salmonella Typhi*, has been determined to be the most common infectious pathogen in South and Southeast Asia. In Bangladesh, the majority of people who experience fever, diarrhea, colds, and other nonspecific symptoms take antibiotics without a doctor's prescription. Furthermore, when treating fever, diarrhea, and other infectious disorders, the majority of doctors in Bangladesh use antibiotics without performing a precise diagnostic or drug sensitivity test. Because of this, many patients do not improve or get better after taking antibiotics for the first, second, or even third time. The main risk factors for *Salmonella Typhi* development of antibiotic resistance are misuse, overuse, and incorrect use of antimicrobial drugs. This is a typical situation in Bangladesh's Chattogram City.[23]

9. NEPAL

Typhoid and enteric fever are both caused by Salmonella serotypes typhi and paratyphi. In underdeveloped countries like Nepal, it is one of the most important public health challenges. The Kathmandu Valley's recent fast urbanization and population growth have been mostly caused by unhygienic conditions and fecal contamination of drinking water. Every one of these elements plays a role in the alarming frequency of typhoid fever within the country. Infections such as typhoid fever, or Bisham Jwar, are widespread in Nepal. It is limited to the southern Terai region, the lowlands, and the highlands. The months from May to August are the most common for transmission. *Salmonella serovar* is the most common pathogen detected in blood cultures in Nepal. Previous studies carried out in Kathmandu have shown that typhoid disease is more common in regions with low socioeconomic levels and unsanitary living conditions. Among the symptoms of the illness are prolonged fever, leukopenia, nausea, vomiting, constipation, headache, rash, malaise, and appetite loss. Ten percent of people who recover from typhoid fever carry *Salmonella Typhi* for the rest of their lives, and two to three percent carry the infection for three months through their stool. These illnesses have a high likelihood of spreading. [24]

CONCLUSION

Several studies have been conducted during the last decade which focused on typhoid fever in Asia, which stepped forward our information about the prevalence of the sickness and the population at risk. These studies showed that sickness prevalence, severity, and mortality rates were higher in this region. They have shed light on factors that can contribute to severe outcomes, consisting of a lack of admission to healthcare, take away in evaluation and treatment, terrible sanitation, and lack of stable water. There are gaps in our knowledge on the prevalence of typhoid fever and the latest method for enforcing prevention strategies in low-resource settings,although more comprehensive data and numerous proven prevention options are available, challenges still exist. Future efforts could likely emphasize improving prevention, treatment, and evaluation strategies to reduce its prevalence. In developing countries, efforts to enhance the delivery of stable water, sanitation, and health infrastructure need to be developed.

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