

Non Typhoidal Salmonellosis (NTS) : A Global concern

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Salmonellosis is a public health problem worldwide. It is caused by enteroinvasive bacteria belonging to the genus *Salmonella*. Medically Salmonellae have been classified into typhoidal (*S. Typhi*, *S. Paratyphi A*, *S. Paratyphi B*) and nontyphoidal (eg; *S. Typhimurium* and *S. Enteritidis*). Non-Typhoidal *Salmonella* (NTS) species are important food-borne pathogens worldwide. Their widespread distribution in the environment; increasing prevalence in the global food chain; virulence and adaptability have an enormous medical, public health, and economic impact worldwide. In India, Typhimurium and Enteritidis are the commonest nontyphoidal serotypes, but occurrence of rare serotypes like *S. Worthington*, *S. Wien*, *S. Virchow*, and *S. Dublin* have been reported in literature.

In humans, NTS infections are most often associated with food products of animal origin, including meat, poultry, eggs, and dairy products. Outbreaks of *S. Enteritidis* infection have been associated with ingestion of uncooked or lightly cooked eggs. Recently foodborne outbreaks of salmonellosis associated with cantaloupe, tomatoes, unpasteurized orange juice, cilantro, and raw seed sprouts have also been reported. Manufactured food items also pose an enormous potential hazard of foodborne salmonellosis. Although foodborne outbreaks predominate, waterborne outbreaks of salmonellosis also have been reported. About 3% to 5% of all cases of salmonellosis in humans are associated with exposure to exotic pets, especially reptiles.

Salmonella infections begin with the ingestion of bacteria in contaminated food or water. As few as 10^3 bacteria may produce nontyphoidal gastroenteritis in exposed individuals. Nontyphoidal *Salmonella* gastroenteritis is characterized by massive polymorphonuclear leukocyte infiltration into both the large- and the small-bowel mucosa. The degranulation and release of toxic substances by neutrophils may result in damage to the intestinal mucosa; causing the inflammatory diarrhea observed with nontyphoidal gastroenteritis. The generalized invasion of enterocytes plays a greater role in the enteritis induced by nontyphoidal *Salmonella* serotypes.

The diagnosis of NTS infection is based on the isolation of the organism from freshly passed stool or from blood and characterizing the organism phenotypically. Subtyping methods are used for epidemiological purposes to differentiate strains of common *Salmonella* serotypes. However, lack of standardization and time requirement limits the widespread use of genotyping techniques.

Infection with nontyphoidal Salmonellae most often results in self-limited acute gastroenteritis. Occasionally, patients may require hospitalization for dehydration, and death occurs very infrequently. After resolution of gastroenteritis, the mean duration of carriage of nontyphoidal *Salmonella* in the stool is 4 to 5 weeks and varies by *Salmonella* serotype. Antimicrobial therapy may increase the duration of carriage.

From 1% to 4% of immunocompetent individuals with *Salmonella* gastroenteritis develop bacteremia. The major risk factors for nontyphoid salmonellosis and bacteremia are certain immunocompromised conditions or periods, including extremes of age, alteration of the endogenous bowel flora of the intestine, diabetes, malignancy, autoimmune disorders, reticuloendothelial blockade, HIV infection, and therapeutic immunodeficiency. Localized infections such as meningitis, pneumonia, suppurative arthritis, and osteomyelitis develop in approximately 5% to 10% of persons with *Salmonella* bacteremia. Predisposing factors include local trauma and immunosuppression.

Salmonella gastroenteritis is usually a self-limited disease, and therapy primarily should be directed to the replacement of fluid and electrolyte losses. Antimicrobial therapy should be considered for neonates, persons older than 50 years, and those with immunosuppression or cardiac valvular or endovascular abnormalities, including prosthetic vascular grafts. Treatment consists of an oral or intravenous antimicrobial administered for 48 to 72 hours or until the patient becomes afebrile. For susceptible organisms, treatment with an oral fluoroquinolone, trimethoprim-sulfamethoxazole, or amoxicillin is adequate.

Empirical therapy for life-threatening bacteremia or focal infection suspected to be caused by nontyphoidal *Salmonella* should include a third-generation cephalosporin and a fluoroquinolone until susceptibilities are known. In addition, early surgical resection of infected aneurysms or other infected endovascular sites is recommended.

Antimicrobial resistance among human nontyphoidal *Salmonella* isolates is increasing worldwide and is likely due, in part, to the widespread use of antimicrobial agents for the empirical treatment of febrile syndromes and as antimicrobial agents in animal feeds. In a recent study from India, 48 % of nontyphoidal *Salmonella* isolates possessed the extended-spectrum cephalosporin resistance phenotype, with PCR amplification and sequencing revealing that isolates possessed TEM-1, SHV-12, DHA-1, OXA-1-like and CTX-M-15 ESBL genes. The involvement of efflux pumps was detected in 19 % of isolates resistant to ciprofloxacin.

Vaccination of feed animals, limiting the use of antimicrobials as growth promoters, and improved food safety practices should further reduce the burden of foodborne salmonellosis. Research is going on the development of a bivalent vaccine against Typhimurium and Enteritidis which can pave way for protection against these most common nontyphoidal *Salmonella* serotypes, thereby decreasing the morbidity and mortality associated with them.

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