***Salmonella typhi* and *paratyphi***

The Enterobacteriaceae are a large, heterogeneous group of gram-negative rods whose natural habitat is the intestinal tract of humans and animals. The family includes many genera (*Escherichia, Shigella, Salmonella, Enterobacter, Klebsiella, Serratia*, *Proteus*, and others).

Salmonellae are often pathogenic for humans or animals when acquired by the oral route. They are transmitted from animals and animal products to humans, where they cause enteritis, systemic infection, and enteric fever. Salmonellae vary in length. Most isolates are motile with peritrichous flagella. Salmonellae grow readily on simple media, but they almost never ferment lactose or sucrose. They form acid and sometimes gas from glucose and mannose. They usually produce H2S. They survive freezing in water for long periods. Salmonellae are resistant to certain chemicals (eg, brilliant green, sodium tetrathionate, sodium deoxycholate) that inhibit other enteric bacteria; such compounds are therefore useful for inclusion in media to isolate salmonellae from feces.

***“Salmonella typhi* causes Typhoid fever whereas *Salmonella paratyphi* causes Paratyphoid fever”**

Classification

The classification of salmonellae is complex because the organisms are a continuum rather than a defined species.

The members of the genus ***Salmonella*** were originally classified on the basis of epidemiology; host range; biochemical reactions; and structures of the O, H, and Vi (when present) antigens.

The names (eg, ***S typhi***, ***Salmonella typhimurium***) were written as if they were genus and species. There are more than 2500 serotypes of salmonellae, including more than 1400 in DNA hybridization group I that can infect humans.

Four serotypes of **Salmonellae** that cause **enteric fever** can be identified in the clinical laboratory by biochemical and serologic tests. These serotypes should be routinely identified because of their clinical significance. They are as follows: ***Salmonella Paratyphi A* (serogroup A)**, ***Salmonella Paratyphi B* (serogroup B)**, Salmonella Choleraesuis (serogroup C1), and ***S Typhi* (serogroup D)**.

**Pathogenesis**

**S Typhi,** S Choleraesuis**,** and perhaps **Salmonella Paratyphi A** and **Salmonella Paratyphi B** are primarily infective for humans, and infection with these organisms implies acquisition from a human source.

1. Salmonella organisms penetrate the mucosa of both small and large bowel, coming to lie intracellularly where they proliferate.
2. There is not the same tendency to mucosal damage as occurs with Shigella infections but ulceration of lymphoid follicles may occur.
3. The evolution of typhoid is fascinating. Initially S. typhi proliferates in the second part of the Payer’s patches of the lower small intestine from where systemic dissemination occurs, to the liver, spleen, and reticuloendothelial system.
4. For a period varying from 1 to 3 weeks the organism multiplies within these organs. Rupture of infected cell occurs, liberating organisms into the bile and for a second time cause infection of the lymphoid tissue of the small intestine paticularly in the ileum.
5. It is this phase of heavy infection that brings the classical bowel pathology of typhoid in its train. Invasion of the mucosa causes the epithelial cells to synthesise and release various proinflammatory cytokines including IL-1, IL-6, IL- 8, TNF-β, INF, GM-CSF etc.

**Transmission**

*Salmonella*Typhi lives only in humans. People with typhoid fever carry the bacteria in their bloodstream and gut. In addition, a small number of people, called carriers, recover from typhoid fever but continue to carry the bacteria. Both ill people and carriers shed *Salmonella*Typhi in their faeces and urine.

The bacteria are spread by eating food or drinking water contaminated by faeces or urine of patients and carriers. Common sources are:

* water or ice
* raw vegetables
* salads
* shellfish.

If fruit and vegetables are washed in contaminated water they may cause illness.

Typhoid is common in areas of the world where hygiene standards are poor and water is likely to be contaminated with sewage. These illnesses are no longer common in developed countries, with most cases occurring in areas such as:

* Asia
* the Middle East
* Central and South America
* parts of southern Europe
* Africa.

**Symptoms of S. typhi and S. paratyphi**

Onset of illness is gradual, with**:**

* sustained high fever
* marked headache
* malaise (feeling of being unwell)
* decreased appetite
* enlarged spleen which may cause abdominal discomfort
* dry cough in the early stage of the illness
* a flat rose-coloured rash which may be visible on the trunk
* constipation or diarrhoea – constipation occurs more often than diarrhoea in adults.

Illness varies from mild with low-grade fever, to severe with multiple complications.

People who do not get treatment may continue to have fever for weeks or months, and as many as 20% may die from complications of the infection. With treatment, the death rate falls to about 1%. Paratyphoid has similar symptoms to typhoid, although the illness tends to be milder

From 3 days to more than 60 days; usually

* typhoid - 8 to 14 days
* paratyphoid - 1 to 10 days.

Infectious period

*(time during which an infected person can infect others)*

As long as the bacteria are shed in the faeces or urine, usually from the first week of illness until completely recovered. About 10% of untreated typhoid patients will be infectious for 3 months after onset of symptoms and 2 to 5% become permanent carriers. Fewer people with paratyphoid become carriers

**Prophylaxis**

Antimicrobial therapy of invasive Salmonella infections is with ampicillin, trimethoprim–sulfamethoxazole, or a third-generation cephalosporin. Multiple drug resistance transmitted genetically by plasmids among enteric bacteria is a problem in Salmonella infections. Susceptibility testing is an important adjunct to selecting a proper antibiotic. In most carriers, the organisms persist in the gallbladder (particularly if gallstones are present) and in the biliary tract. Some chronic carriers have been cured by ampicillin alone, but in most cases cholecystectomy must be combined with drug treatment.

**Control**

Sanitary measures must be taken to prevent contamination of food and water by rodents or other animals that excrete salmonellae. Infected poultry, meats, and eggs must be thoroughly cooked. Carriers must not be allowed to work as food handlers and should observe strict hygienic precautions.

**Reference**

1. **Jawetz, Medical Microbiology, twenty-third edition, International edition**