Typhoid and Paratyphoid Fever

Manitoba Health
Public Health
Communicable Disease Control Unit

Case Definition

Confirmed Case: Isolation of *Salmonella typhi* or *S. paratyphi A, B, C* from a clinical specimen.

Reporting Requirements

- All positive specimens are reportable by laboratory.
- All cases are reportable by attending health care professional.

Clinical Presentation/Natural History

Systemic bacterial diseases characterized by insidious onset of sustained fever, severe headache, malaise, anorexia, a relative bradycardia, splenomegaly, rose spots on the trunk in greater than 25% of Caucasian persons, nonproductive cough in the early stage of the illness, and constipation more commonly than diarrhea (in adults). Many mild and atypical infections occur.

In typhoid fever, ulceration of Peyer's patches in the ileum can produce intestinal hemorrhage or perforation (about 1% of cases), especially late in untreated cases. Severe forms have been described with cerebral dysfunction. Non-sweating fever, mental dullness, slight deafness and parotitis may occur. The usual case-fatality rate of 10% can be reduced to less than 1% with prompt antibiotic therapy. Relapses occur in 5-10% of untreated cases and may be more common (15-20%) following therapy with appropriate antibiotics. Mild and inapparent illnesses occur, especially in endemic areas.

Paratyphoid fever has a similar clinical picture, but tends to be milder, and the case-fatality rate is much lower. The ratio of disease caused by *Salmonella typhi* to that caused by *S. paratyphi* is about 10:1. Relapses may occur in approximately 3-4% of cases. When the salmonella infections are not systemic, they are manifested only by a gastroenteritis (see Salmonellosis).

Etiology

For typhoid fever, *Salmonella typhi*, the typhoid bacillus. At present, 107 types can be distinguished by phage typing, which is valuable in epidemiologic studies.

For paratyphoid fever, three bioserotypes of *S. enteritidis* are recognized: Paratyphi A, Paratyphi B (*S. schottmülleri*) and Paratyphi C (*S. hirschfeldii*). A number of phage types can be distinguished.

Epidemiology

Reservoir and Source: Humans for both typhoid and paratyphoid; rarely, domestic animals for paratyphoid. Family contacts may be transient or permanent carriers. In most parts of the world, short-term fecal carriers are more common than urinary carriers. The carrier* state may follow acute illness, mild or even subclinical infections. The chronic carrier state is most common among persons infected during middle age, especially women; carriers frequently have biliary tract abnormalities including gallstones. The chronic urinary carrier state occurs in those with schistosome infections. In one outbreak of paratyphoid fever in England, dairy cows excreted Paratyphi B organisms in milk and feces.

* The term "carrier" is loosely defined. A "chronic carrier state" has been defined as persistence of organisms in stool/urine for more than one year.

Transmission: By food and water contaminated by feces and urine of patients and carriers. Important vehicles in some countries include shellfish taken from sewage-contaminated beds (particularly oysters), raw fruits, vegetables fertilized by nightsoil and eaten raw, contaminated milk and milk products (usually by hands of carriers) and missed cases. Flies may infect foods in which the organism then multiplies to achieve an infective dose, which is much lower for typhoid than for paratyphoid bacteria.

Occurrence:

General: Worldwide; the annual incidence of typhoid fever is estimated at about 17 million cases with approximately 600,000 deaths. The number of sporadic cases of typhoid fever has remained relatively constant in the United States, with fewer than 500 cases annually for several years (compared to 2,484 reported in 1950). With development of sanitary facilities, the disease has been virtually eliminated from many areas; most cases now are imported from endemic areas. Strains resistant to chloramphenicol and other recommended antibiotics have become prevalent in several areas of the world. Multidrug-resistant strains have been reported from Asia, the Middle East and Latin America.

Paratyphoid fever occurs sporadically or in limited outbreaks, probably more frequently than reports suggest. In the United States and Canada, paratyphoid fever is infrequently identified. Of the three serotypes, paratyphoid B is most common, A less frequent and C extremely rare.

Manitoba: Between 1995 and 1999, 12 cases of typhoid were reported. During this same period, there were 9 reported cases of paratyphoid.

Incubation Period: The incubation period depends on the size of the infecting dose; from three days to three months with a usual range of one to three weeks. For paratyphoidal gastroenteritis, one to 10 days.

Susceptibility and Resistance: Susceptibility is general and is increased in persons with gastric achlorhydria or those who are HIV positive. Relative specific immunity follows recovery from clinical disease, inapparent infection and active immunization, but is inadequate to protect against subsequent ingestion of large numbers of organisms. In endemic areas, typhoid fever is most common in preschool and school-aged children (five to 19 years of age).

Period of Communicability: As long as the bacilli appear in excreta, usually from the first week throughout convalescence; variable thereafter (commonly one to two weeks for paratyphoid). About 10% of untreated typhoid fever patients will discharge bacilli for three months after onset of symptoms, and 2-5% become permanent carriers; considerably fewer persons infected with paratyphoid organisms may become permanent gallbladder carriers.

Diagnosis

The etiologic organisms can be isolated from the blood early in the disease and from urine and feces after the first week. Bone marrow culture provides the best bacteriologic confirmation (90-95% recovery) even in persons who have already received antibiotics. A four-fold rise in somatic (O) agglutination titres in paired sera appears during the second week in less than 70% of cases of typhoid fever; when it occurs, it supports the diagnosis, provided vaccine had not been given recently. Because of its limited sensitivity, serologic tests are of little diagnostic value. New techniques using monoclonal antibodies to detect H antigen in the blood are under development.

The presence of elevated titres of antibody to purified Vi polysaccharide is highly suggestive of the typhoidal carrier state.

Key Investigations

- Source of infection, particularly travel history and consumption of shellfish.
- Identification of household/travel contacts.
- Immunization history.

Control

Management of Cases:

Treatment:

- Chloramphenicol, amoxicillin or TMP-SMX (particularly in children) have

comparable high efficacy for acute infections. Quinolone derivatives are quite effective (e.g., Ciprofloxacin 500 mg po. b.i.d. x 10 days), as are the third-generation cephalosporins.

- All isolates should be checked for drug resistance; some strains that are resistant to chloramphenicol, ampicillin and amoxicillin are sensitive to TMP-SMX or ciprofloxacin.
- A five-day course of ceftriaxone (IV) was found in one study to be as effective as the conventional 14-day treatment with chloramphenicol.
- Short-term, high-dose corticosteroid treatment (Dexamethasone 3mg/kg then 1mg/kg q6h for eight doses), combined with specific antibiotics and supportive care, clearly reduces mortality in critically ill patients.
- Patients with concurrent schistosomiasis must also be treated with praziquantel to eliminate possible carriage of *S. typhi* bacilli by the schistosomes.
- In recent studies, the new oral quinolones have produced excellent results in the treatment of the carrier, even when biliary disease exists; follow-up cultures are necessary to confirm cure.

Public Health Measures:

- Patients must be advised of the importance and effectiveness of handwashing with soap and water after defecation.
- Contact precautions should be used for hospitalized children and adults who have poor hygiene or incontinence that cannot be contained. Otherwise routine infection control precautions are adequate.
- Release from supervision by local health authority should be based on no fewer than three consecutive negative cultures of feces (and urine in patients with schistosomiasis) taken at least 24 hours apart and at least 48 hours after any antibiotic, and not earlier than one month after onset. If any one of these is positive, repeat cultures at intervals of one month during the 12-month period following onset until at least three consecutive negative cultures are obtained. If persons have been excreting organisms for one or more years, at least one of the stool specimens should be obtained by purging.
- Persons excreting typhoid bacilli in stools or urine should be excluded from handling food; those involved in providing patient or child care should be assessed on an individual basis. Instruct patients, convalescents and carriers in personal hygiene and handwashing before preparing and serving food.

Management of Contacts:

- Public health nurses will identify contacts and make arrangements for specimen collection if necessary.
- Routine administration of typhoid vaccine is of limited value for family, household and nursing contacts who have been or may be exposed to active cases; it should be considered for those who may be exposed to carriers.
- There is no effective immunization for paratyphoid A fever.
- Household and close contacts (especially close travel contacts) should be questioned regarding symptoms (headache, fever, diarrhea, constipation and malaise) and investigated for infection if symptomatic. Regardless of symptoms they should not be employed in occupations involving food handling until at least two negative stool specimens, taken at least 24 hours apart, are obtained. Depending on an individual assessment, this requirement should also be extended to persons in child or patient care.

Preventive Measures:

- Persons travelling to endemic areas should receive typhoid vaccine prior to departure.
- Vaccine should be provided to persons working with the organisms in laboratory settings.
- The live, oral typhoid vaccine has shown some protection against paratyphoid B infection.
- Shellfish should be boiled or steamed for at least 10 minutes before serving.

Management of Outbreaks:

- Investigate source of infection and take appropriate measures including treatment, surveillance cultures and exclusion from work to prevent further transmission.