

Typhoid and Paratyphoid Fever

Typhoid

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without symptoms:

- Isolation of *Salmonella* typhi from an appropriate clinical specimen.

Probable Case

Clinical illness^[1] in a person who is epidemiologically linked to a confirmed case.

Paratyphoid

Case Definition

Confirmed Case

Laboratory confirmation of infection with or without symptoms:

- Isolation of *Salmonella* Paratyphi A, B, or C from an appropriate clinical specimen

Probable Case

Clinical illness^[1] in a person who is epidemiologically linked to a confirmed case.

^[1] Clinical illness is characterized by insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation, or diarrhea.

Note: AHW maintains a Typhoid/Paratyphoid Registry for purposes of monitoring carriers as they potentially pose a long term health risk for transmission of disease.

Reporting Requirements

1. Physicians/Health Practitioners and others

Physicians, health practitioners, and others listed in Section 22 of the Public Health Act shall notify the MOH (or designate) by the

fastest means possible i.e., direct voice communication, about the following:

- all confirmed and probable cases of typhoid and
- all confirmed and probable cases of paratyphoid.

2. Laboratories

All laboratories [including regional laboratories and the Provincial Laboratory of Public Health (PLPH)] shall report all positive laboratory results by the fastest means possible i.e., direct voice communication to the:

- CMOH (or designate),
- MOH (or designate), and
- attending/ordering physician.

3. Regional Health Authority

- The MOH (or designate) shall notify the CMOH (or designate) by the fastest means possible i.e., direct voice communication of all confirmed and probable cases.
- The MOH (or designate) shall forward the preliminary NDR of all confirmed and probable cases to the CMOH (or designate) within seven days (one week) of notification and the final NDR (amendments) within two weeks of notification.
- For out of region reports, the MOH (or designate) first notified shall notify the MOH (or designate) where the client resides by the fastest means possible i.e., direct voice communication and immediately fax a copy of the positive laboratory report.
- For out of province and out of country reports, the following information should

be forwarded to the CMOH (or designate) by the fastest means possible i.e., direct voice communication including:

- name,
- date of birth,
- out of province health care number,
- out of province address and phone number,
- attending physician (locally and out of province), and
- positive laboratory report (faxed).

Etiology

Typhoid fever is caused by *Salmonella typhi*. 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. schottmulleri*), and Paratyphi C (*S. hirschfeldii*). A number of phage types can be distinguished.

Clinical Presentation

Typhoid is a systemic bacterial disease. Mild and inapparent illness may occur, especially in endemic areas. Infection is characterized by insidious onset of sustained fever, severe headaches, malaise, anorexia, a non productive cough (in the early stage of the illness), a relative bradycardia, and hepatosplenomegaly (50%). Approximately 30% of Caucasians will develop rose spots on the trunk. In adults, constipation is more common than diarrhea (10% to 38%). Only 20% to 40% of people will initially have abdominal pain. Nonspecific symptoms such as chills, diaphoresis, headache, anorexia, cough, weakness, sore throat, dizziness, and muscle pains are frequently present before the onset of fever. Psychosis and confusion occur in 5% to 10% of people. Seizures and coma are reported in less than 1%. The severity of illness is dependent on the infecting dose. When salmonella infections are not systemic, they are

manifested only by gastroenteritis (see Salmonellosis).

The ulceration of Peyer's patches in the ileum may be a complication of infection. This can produce intestinal hemorrhage or perforation (3% to 10% of cases), especially late in untreated cases. Severe forms of infection have been described resulting in 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 treatment. Relapse occurs in 5% to 10% of untreated cases and is also common (15% to 20%) following therapy with appropriate antibiotics.

Paratyphoid, like typhoid, is a systemic bacterial disease. The clinical manifestations tend to be milder, and the case-fatality rate is much lower. Ratio of disease caused by *Salmonella typhi* to that caused *S. paratyphi* is about 10:1. Relapses occur in approximately 3% to 4% of cases.

A chronic carrier status is defined as persistence of the organism in stool for more than one year and occurs in 1% to 4% of cases. The carrier state may follow acute illness, mild or even subclinical infections. It is most common when individuals (especially women) are infected during middle age and in those with biliary tract abnormalities including gallstones.

Diagnosis

The etiologic organisms can be isolated from the blood early in the disease, and from feces after the first week. Bone marrow culture provides the best bacteriologic confirmation (90% to 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 and when it occurs, it supports the diagnosis,

provided vaccine had not been given recently. The sensitivity of blood culture alone is only 50% to 70%. The presence of elevated titres of antibody to purified Vi polysaccharide is highly suggestive of the typhoidal carrier state.

Epidemiology

Reservoir

Humans and, rarely, domestic animals are the reservoirs for typhoid and paratyphoid.

Family contacts may be transient or permanent carriers and inadvertently spread infection

In one outbreak of paratyphoid fever in England, dairy cows excreted *S. Paratyphi B* organisms in milk and feces. Paratyphi B infection has also been linked to tropical fish and tropical fish aquariums ⁽¹⁾.

Transmission ^(2, 3, 4)

Typhoid and paratyphoid are transmitted by food and water contaminated by feces of patients and carriers (fecal-oral). The infection is rarely spread by casual contact. Important vehicles include shellfish taken from sewage-contaminated beds (particularly oysters), raw fruits, vegetables fertilized by night soil (human excrement) 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. The infective dose for typhoid is much lower than for paratyphoid.

Incubation Period

The incubation period depends on the size of the infecting dose. For typhoid, the incubation period ranges from three days to three months, most commonly one to three weeks. The incubation period for paratyphoid gastroenteritis is generally one to 10 days.

Period of Communicability

Typhoid and paratyphoid are communicable as long as the bacilli appear in excreta, usually from the first week throughout convalescence. The shedding is variable thereafter. About 10% of untreated typhoid fever patients will discharge bacilli for three months after onset of symptoms, and 1% to 4% will become permanent carriers. Considerably fewer persons infected with paratyphoid organisms may become permanent gallbladder carriers.

Host Susceptibility

Susceptibility is general and is increased in persons with alterations in the gastrointestinal tract, including decreased gastric acidity, those who are HIV positive, have had organ transplants, and lymphoproliferative disease. Relative specific immunity follows recovery from clinical disease, inapparent infection, and active immunization, but is inadequate to protect against subsequent ingestion of a large number of organisms. In endemic areas, typhoid fever is most common in preschool and school-aged children (five to 19 years of age).

Occurrence

General

Both typhoid and paratyphoid occur worldwide. The annual incidence of typhoid fever globally is estimated at about 12 to 33 million cases with approximately 600,000 deaths. It is endemic in many developing countries, particularly the Indian subcontinent, South and Central America, and Africa with annual incidence rates estimated to be as high as 900/100,000 in Asia. The number of sporadic cases of typhoid fever has remained relatively constant in the US, with fewer than 500 cases annually for several years (compared to 2484 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 US and Canada, paratyphoid fever is infrequently identified. Of the three serotypes, paratyphoid B is most common, A less frequent and C extremely rare.

Canada ⁽⁴⁾

The incidence of typhoid is very low in Canada. From 1993 to 2002, 806 cases were reported, averaging 73 cases per year. The number of cases reported annually has remained constant. The greatest risk of typhoid infection for Canadians occurs while they are travelling in countries or regions of countries where sanitation is likely to be poor and exposures to food and water occurs in uncontrolled settings. (i.e., market stalls, street vendors and home restaurants) ⁽⁵⁾. Persons aged 30 to 39 years account for the most number of reported cases followed closely by the 25 to 29 year age group. Females and males are equally at risk.

Paratyphoid is uncommon in Canada with an average of 24 cases reported annually from 1993 to 2002. The most common age group and the gender ratios are similar to that of typhoid.

Alberta ⁽⁴⁾

A case of typhoid is rare in Alberta. Seventy-one cases were reported between

1993 and 2002 with an average of six cases per year. In 2003, 15 cases were reported. Six of the cases occurred in children one to four years of age. Fourteen of the cases were recent immigrants who had returned to the Indian subcontinent to visit. The majority of these cases were diagnosed in urban health regions. Seven cases were reported in 2004.

The greatest risk of typhoid infection for Albertans appears to be travel to countries where sanitation is likely to be poor. The most common age group diagnosed with typhoid prior to 2003 was aged 20 to 24 years followed closely by the 30 to 39 year old age group. Individuals diagnosed with paratyphoid were most commonly 30 to 39 years of age. Males and females are equally at risk.

Key Investigation

- Determine the possible source of infection taking into consideration the incubation period, reservoir, and mode of transmission. Assessment may include:
 - determining history of travel,
 - obtaining a food history including consumption of shellfish, and
 - determining history of high risk sexual practices especially contact with feces.
- Identify history of residing in areas with poor sanitation including improper water treatment and sewage disposal and include recent immigration.
- Determine immunization history.
- Identify underlying medical conditions i.e., decreased gastric acidity, HIV infection, organ transplants, and lymphoproliferative disease.
- Determine occupation and attendance at daycare/dayhome or other type of institutional contact (e.g., continuing care facility). Refer to the document “Enteric

Transmission Risk Assessment - Public Health Follow-Up”, for a list of groups who are at high risk of transmitting infection.

- Identify symptomatic household members or other close contacts (e.g. travel companions) who have recently travelled to developing countries.
- Identify contacts. Contacts include
 - household members,
 - recent travel companions to developing countries, and
 - intimate non-household members.
- When paratyphoid is diagnosed, determine ownership of tropical fish and tank ⁽¹⁾.

Control

Management of a Case

- All cases should be instructed about disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Contact precautions should be used for the duration of acute illness as well as with hospitalized children and adults who have poor hygiene or incontinence that cannot be contained. Otherwise, routine infection control precautions are adequate.
- Exclusion should be considered for symptomatic and asymptomatic persons who are:
 - food handlers whose work involves
 - touching unwrapped food to be consumed raw or without further cooking and/or
 - handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking,
 - healthcare, daycare or other staff who have contact through serving food with highly susceptible patients or persons, in whom an intestinal infection would have particularly serious consequences,

- involved in patient care or care of young children, elderly or dependent persons,
- children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene,
- older children or adults who are unable to implement good standards of personal hygiene (e.g., mentally or physically challenged).
- Exclusion applies until two consecutive stool specimens taken from the infected person are reported as negative submitted:
 - at least 21 days following completion of antibiotic,
 - not less than 24 hours apart, and
 - when normal stool has resumed.
- If one or both samples are positive, continue to collect samples at specified intervals. Refer to the attached “Typhoid/Paratyphoid Stool Collection Algorithm: Acute Cases in a Special Risk Group” to determine sequencing.
- Continued public health surveillance is not required for cases that do not pose a risk of transmission to others. Follow-up with the personal physician for clearance of the organism is recommended.

Chronic carriers

- Individuals who continue to shed *Salmonella typhi*/*Salmonella paratyphi* for one year are considered carriers.
- Carriers are generally excluded from food handling and patient care until two stool specimens taken at least one month apart and at least 48 hours after cessation of antibiotics are reported as negative. Refer to the document “Enteric Transmission Risk Assessment - Public Health Follow-Up”.
- The monitoring of carriers is maintained through the AHW Typhoid/Paratyphoid Registry.

- Medical intervention may be indicated for individuals who carry *S. typhi*/*S. paratyphi* in the gall bladder, etc.

Treatment ⁽⁵⁾

- The major treatment options for typhoid/paratyphoid are:
 - ciprofloxacin for 10 days or
 - ceftriaxone/cefotaxime for 14 days, or
 - azithromycin (second line oral agent).
- Short-term, high-dose corticosteroid treatment, combined with specific antibiotics and supportive care, clearly reduced 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.

Management of Contacts

- Contacts should be instructed about disease transmission, appropriate personal hygiene, routine practices, and contact precautions.
- Symptomatic contacts should be assessed by a physician.
- **Contacts of a case**
 - Symptomatic contacts will be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons until:
 - Two consecutive stool specimens taken not less than 24 hours apart and reported as negative prior to returning to daycare or similar

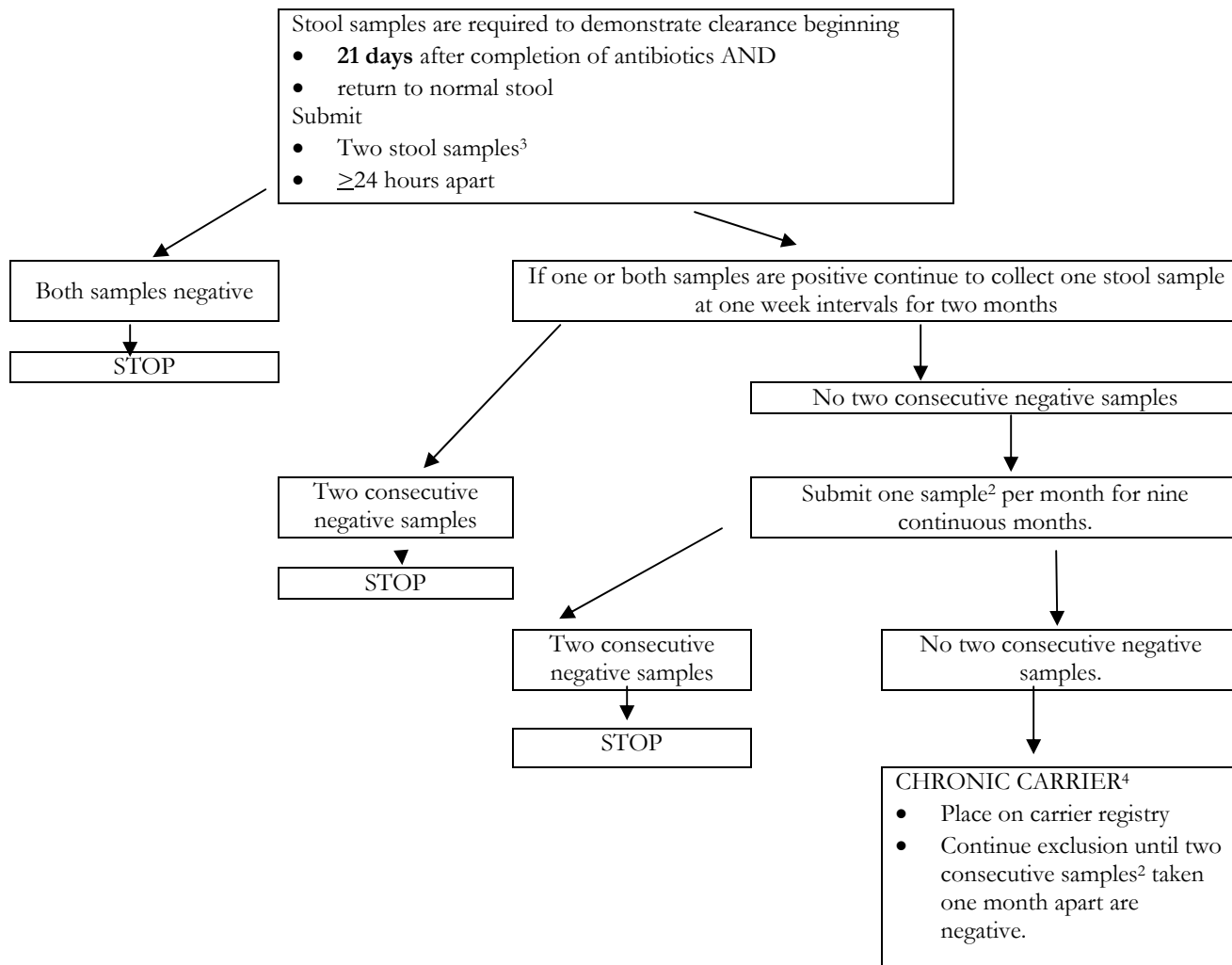
- facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
- Asymptomatic household contacts will generally be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
 - One stool specimen must be reported as negative prior to returning to daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
 - Consultation with the MOH is appropriate.
- A contact is subject to surveillance for the duration of the incubation period if the time of exposure is known.
- **Contacts of carriers**
 - Symptomatic contacts will generally be excluded from daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
 - Two consecutive stool specimens taken not less than 24 hours apart must be reported as negative prior to returning to daycare or similar facilities or occupations involving food handling, patient care or care of young, elderly or dependent persons.
 - Asymptomatic contacts are not excluded and no stool specimens are required.
 - Typhoid vaccine may be recommended, in consultation with the CMOH, for people with ongoing household or intimate exposure to a *S. typhi* carrier ⁽⁴⁾. The vaccine is of limited value for family, household

- and nursing contacts that may have or have been exposed to active cases.
- Public health follow up is generally not required for contacts of a case or carrier who do not pose a risk of transmission to others, however, stool samples may be requested to determine the source of the infection in the case.
- Educate owners of tropical fish aquariums to ensure scrupulous cleaning of aquariums to eliminate potential *S. paratyphi B* organisms.

General Preventive Measures

- Provide public education about personal hygiene, especially the sanitary disposal of feces and careful hand washing after defecation and sexual contact, and before preparing or eating.
- Educate food handlers about proper food and equipment handling and hygiene.
- Persons travelling to developing countries with poor sanitation should receive typhoid vaccine prior to departure.
 - The live, oral typhoid vaccine has shown some protection against paratyphoid B infection.
- All travellers should seek out and be provided with information regarding water, sanitation, and food preparation while travelling as well as proper handwashing techniques.
- Advise infected individuals to avoid food preparation.
- Educate regarding good personal hygiene, especially hand washing for staff and children in institutions and daycares.
- Educate about the risks of sexual practices that permit fecal-oral contact.
 - Educate about condom use for safer sex.
- Typhoid vaccine should be considered for laboratory workers who frequently handle cultures of *S. typhi* ⁽⁴⁾.
- Shellfish should be boiled or steamed for at least 10 minutes before serving.

Typhoid/Paratyphoid Stool Collection Algorithm: ACUTE CASE IN A SPECIAL RISK GROUP



¹ Special Risk Groups

- Food handlers whose work involves touching unwrapped food to be consumed raw or without further cooking or handling equipment or utensils that touch unwrapped food to be consumed raw or without further cooking. Food handlers who do not touch food, equipment or utensils in this way are not considered to pose a transmission risk.
- Health care, nursery, or other staff who have direct contact, or contact through serving food, with highly susceptible patients or persons, in whom and intestinal infection would have particularly serious consequences.
- Persons involved in patient care or the care of young children, elderly people or dependent people.
- Children attending daycares or similar facilities who are diapered or unable to implement good standards of personal hygiene.
- Older children and adults who are unable to implement good standards of personal hygiene (e.g., the mentally or physically challenged).
- Household contacts who are in occupations involving food handling, patient care or care of young children, elderly people or dependent people.

² The client must not be taking antibiotics and have normal stools when samples are taken.

³ For persons who continue to shed the bacteria, the majority of cases are positive on the first sample. Because of the risk of intermittent shedding, a second sample is requested.

⁴ Chronic Carrier – persistence of organism in the stool for more than one year. The client should be advised to consider investigation for underlying medical conditions that perpetuate typhoid in stool e.g., gallstones, etc.

References

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