

PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on “**Salmonella infections in Canadian children – CPS Podcast.**” These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedcases.com/podcasts.

Salmonella infections in Canadian children – CPS Podcast

Developed by Dr. Michael Prodanuk and Dr. Joan Robinson for PedsCases.com.
October 12, 2019

Introduction:

Welcome to PedsCases and thanks for tuning in to our podcast on the Canadian Paediatric Society practice point: *Salmonella* infections in Canadian children.¹ My name is Michael Prodanuk and I am a pediatric resident at the University of Toronto and the Hospital for Sick Children. This podcast was produced in partnership with Dr. Joan Robinson, a pediatric infectious disease specialist at the University of Alberta and author of the practice point.

Despite *Salmonella* infections being relatively common in Canada, their diagnosis and management remain challenging. Clinicians often have questions around which patients to investigate, who to treat, and antibiotic selection. This podcast will review these important clinical questions.

Objectives

The objectives of this podcast are to:

1. Review the epidemiology of *Salmonella* infections.
2. Recognize the clinical presentations of non-typhoidal (NTS) and typhoidal *Salmonella* infections.
3. Know when and how to investigate *Salmonella* infections.
4. Review antibiotic therapy for *Salmonella* infections.
5. Review prevention strategies for *Salmonella* infections.

Case of NTS

Let's start with a case. You are working in a walk-in clinic when Jisoo, a 12-year-old girl, is brought in by her mothers. She presents with a 5-day history of vomiting and diarrhea. Jisoo reports profuse non-bloody diarrhea, 10-15 episodes per day. She was at a barbeque 7 days ago and ate chicken which may have been undercooked. Several of her friends are also sick with similar symptoms. On exam she is afebrile and well

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appearing, however her mucous membranes are slightly dry and she has mild abdominal tenderness. You are concerned she has gastroenteritis, so send a stool culture which returns positive for *Salmonella* serovar Enteritidis several days later. Should you prescribe Jisoo an antibiotic?

Review of NTS

Before answering this question, let's cover some background information. *Salmonella* organisms are gram negative bacteria that are divided into 2 species, *enterica* and *bongori* with almost all human disease being due to *Salmonella enterica*. The two species are further divided into around 2,500 serovars.² Clinically, there are two distinct types of *Salmonella* infections, non-typhoidal and typhoidal. NTS are associated with a wide array of illness, however typically cause a self-limiting gastroenteritis. Typhoidal infections are caused only by the serovars Typhi and Paratyphi, which produce an invasive infection called typhoid fever.

Let's return to our case. Our patient's stool culture grew serovar Enteritidis, a very common NTS. NTS is carried by a number of animal hosts and transmitted to humans through direct contact or by contaminated food and water. Common contaminated foods include undercooked poultry, eggs, dairy products, ground beef, and produce. Reptiles and amphibians, which may be kept as pets, commonly have NTS in their stool with no symptoms so are also a common source of NTS infections. The incubation period for NTS is usually 12-48 hours, but can extend up to 7 days. Our patient had the most common presentation of NTS, with nausea, vomiting, and non-bloody diarrhea that typically lasts 3-7 days. While gastroenteritis is the most common presentation, NTS may also cause invasive infection including bacteremia, meningitis, and brain abscesses. Immunocompromised hosts, asplenic children or infants <3 months of age are at higher risk of these severe infections. Osteomyelitis and septic arthritis are also seen, however almost exclusively in children with sickle cell disease due to their predisposition for infection by encapsulated organisms.

Now let's talk about diagnosing NTS infections. It was correct to order stool cultures for our patient given her severe persistent diarrhea. Stool cultures should also be ordered if diarrhea is bloody. Blood cultures should be ordered to assess for bacteremia if the child is <3 months old, or if the stool culture is positive and the child is febrile or immunocompromised. The reason for always doing blood culture in young infants is that they can be bacteremic without a fever.

Now let's talk about managing NTS. Does our patient require an antibiotic? For simple gastroenteritis, antibiotics should not be prescribed as they do not decrease the severity or duration of diarrhea, and they may increase the incidence of chronic *Salmonella* carriage. However, if patients are febrile, unwell, or immunocompromised, patients should receive IV antibiotics and be admitted to hospital. The usual choice is

ceftriaxone. Azithromycin is often an appropriate step-down therapy following clinical improvement.

Patients remain infectious while diarrhea persists so should avoid school and daycare until the diarrhea is resolved. There is no need to document a repeat negative stool culture as asymptomatic carriage is harmless and often lasts months in young children. To return to our case, Jisoo is advised to stay home from school until her diarrhea resolves and to observe careful handwashing. She requires only supportive care, including oral rehydration, rest, and over-the-counter analgesics as needed.

Before moving on, let's summarize what we learned about NTS infections:

1. Infection is spread from animal hosts to humans through direct contact or contaminated food and water.
2. Patients usually present with gastroenteritis, however invasive infections may be seen in immunocompromised children.
3. Order stool cultures in patients with persistent or bloody diarrhea.
4. Do not prescribe antibiotics for gastroenteritis, however children should receive antibiotics when there is concern for invasive infection.

Case of typhoid fever

Let's discuss a second case. You are working in the emergency department when Manoj, a 4-year-old boy, is brought in by his parents. He has a 7-day history of fever, abdominal pain, and low appetite. He also had a few days of diarrhea which resolved, and now has not stoolled in 3 days. After taking a careful travel history, you discover that the family returned from India 2 weeks ago, where they stayed with relatives in a rural village and drank well water. On exam he appears unwell, with fatigue and diaphoresis. His temperature is 39.1 C and his heart rate is elevated at 145 beats per minute. There is a macular rash to his abdomen and he has mild hepatomegaly. Manoj is admitted to hospital with concern for sepsis. He receives IV fluid resuscitation and antibiotics. 24 hours later his blood culture returns positive for gram negative bacilli, however his stool culture is negative. What are your next steps in terms of antibiotic management?

Review of typhoid fever

Again, let's review some background information before answering this question. Given his recent travel history and blood culture positive for gram negative bacilli, our patient likely has *Salmonella* Typhi or Paratyphi infection, although NTS remains a possibility pending laboratory confirmation of the serovar. Infection with Typhi or Paratyphi are referred to as typhoid or enteric fever. You will remember that NTS commonly has an animal source but typhoid almost always comes from other humans. Infection is spread from consuming water or food contaminated with feces from a carrier, or direct person-to-person contact. Typhoidal *Salmonella* are endemic to resource-poor countries, with most infections acquired in Asia, and to a lesser degree Africa. The incubation period is

longer than with NTS, typically between 7 to 14 days but can be up to 60 days. Knowing this, our patient likely acquired his infection while visiting family in India.

Typhoid fever is an invasive infection with the potential for sepsis and multi-organ failure. Bacteremia is detected in 80% of cases, but likely is always present. Patients most commonly present with fever and abdominal pain. They may have diarrhea, constipation or normal stools. Involvement of the reticulo-endothelial system leads to hepatomegaly and/or splenomegaly. Rose spots, a macular rash seen over the abdomen, were seen in our patient and are present in 30% of cases. Brain abscess is rare but encephalopathy is more common than with NTS.

Now let's talk about diagnosing typhoid fever. Clinicians must maintain a high index of suspicion as symptoms are often non-specific and the incidence in Canada is low. Blood cultures should be sent for all children with an unexplained fever within 2 months of returning from a resource-poor country. As bacteremia is often low grade, submitting the maximum volume for age in the blood culture vial or submitting two blood cultures may increase yield. Interestingly, stool cultures are often negative if sent more than one week after disease onset, as was the case in our patient.

Unlike NTS infections, typhoid fever should always be treated promptly with antibiotics. Patients with positive blood cultures are usually admitted to hospital and receive empiric ceftriaxone IV initially. Blood cultures should be repeated every 24-48 hours until negative. Patients may be stepped down to oral antibiotics if clinically improved and blood cultures become negative within 48 hours. Fever usually lasts 6-8 days after starting antibiotics, and is not a contraindication to switching to oral antibiotics. However, if there is evidence of disseminated disease, blood cultures take over 48 hours to clear, or the child remains unwell, a pediatric infectious disease specialist should be consulted and the patient should may require a longer course of IV antibiotics. There has been recent concern for the emergence of extensively-drug resistant *Salmonella* Typhi and Paratyphi in Pakistan,³ with one pediatric case resistant to ceftriaxone reported in Canada.⁴ Clinicians should carefully follow up sensitivities and adjust antibiotics accordingly. Azithromycin and ciprofloxacin get good intracellular penetration so may decrease the risk of recurrence. However, laboratories are not yet able to report azithromycin susceptibilities. Almost all isolates are susceptible so it is acceptable to step-down to azithromycin in almost all cases. The total duration of antibiotics depends on the choice of antibiotic and the clinical situation. Call a pediatric infectious disease specialist if you need advice.

To return to our case, Manoj's blood culture subsequently returns positive for *Salmonella* serovar Typhi which is pan sensitive. His fever abates within 24 hours of starting antibiotics and his repeat blood cultures are negative. He is discharged with a 7-day course of azithromycin and advised to follow up with his family physician.

Let's summarize the key points about typhoid fever:

1. Typhoid fever is due to serovars Typhi and Paratyphi which are spread via human hosts.
2. Most infections are acquired in Asia and Africa.
3. Bacteremia is presumed in all cases.
4. All patients should receive antibiotics, in most cases ceftriaxone IV which can be stepped down to oral antibiotics, usually azithromycin.

Prevention

Let's finish up with discussing preventative measures. This falls largely into two main categories, hygiene and vaccination. For NTS, families should be advised to thoroughly cook meats, wash produce, avoid reptiles/amphibians as pets, and diligently wash hands after handling animals and raw meats. Unfortunately, there is no vaccination for NTS at this time.

To prevent typhoid fever, families should be careful about their food and beverage selection when visiting resource-poor countries. Produce washed with local water should be avoided and only bottled water should be consumed. All children 2 years of age and older travelling to South Asian countries should receive the typhoid vaccine. There are several typhoid vaccines currently available in Canada, however only the parenteral inactivated vaccine "Typherix" or "Typhim Vi" are licensed down to the age of 2 years.

Summary

Let's summarize the key learning points from this podcast:

1. *Salmonella* infections are divided into non typhoidal and typhoidal infections.
2. NTS infections are transmitted by contaminated food or water or contact with carrier animals, and present with diarrhea. Antibiotics are not beneficial in the majority of cases.
3. Typhoid fever is transmitted by contaminated food or water or by contact with infected humans, and typically presents with fever upon return from a resource-poor country. If blood cultures are positive or if a patient is unwell, ceftriaxone should be started empirically.
4. Typhoid vaccination is available for children ages 2 and up and should be administered to children travelling to South Asia.

Thank you for listening to our podcast reviewing the Canadian Pediatric Society practice point on *Salmonella* infections in Canadian children. Please stay tuned for future PedsCases podcasts. Special thanks to Erica Shnaider for providing equipment used in the making of this podcast.

References

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