
PEDIATRIC AND ADOLESCENT CARE

CHAPTER 18 – COMMUNICABLE DISEASES

First Nations and Inuit Health Branch (FNIHB) Clinical Practice Guidelines for Nurses in Primary Care.
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ASSESSMENT OF COMMUNICABLE DISEASES

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEMS

When a communicable disease is suspected, a thorough history is essential. Because microorganisms can affect every system, a thorough review of every body system is indicated. Some of the more common symptoms are detailed below.

The following points should be emphasized:

- Onset (date and time) and duration of illness
- Fever, chills or rigors
- Pain
- Rash: site, colour, consistency
- Involvement of mucous membranes or conjunctivae
- Coryza (head cold)
- Cough
- Sore throat
- Drooling
- Vomiting
- Diarrhea
- Level of consciousness
- Irritability
- Seizures
- Contact with a person with similar symptoms or known communicable disease
- Travel history (specifically, recent travel to an area where a communicable disease is endemic)
- Dietary history: raw fish; raw, undercooked or improperly preserved meat
- Immunization history

PHYSICAL EXAMINATION

Many communicable diseases affect more than one body system, so a thorough head to toe examination is indicated. The most common signs are detailed below.

Vital Signs

- Temperature
- Heart rate
- Respiratory rate
- Oxygen saturation
- Blood pressure

Inspection

- Lethargy
- Tachypnea
- Nasal Flaring
- Indrawing/retractions
- Colour
- Coryza
- Pharynx: redness, lesions
- Mucous membranes: moistness, lesions (for example, Koplik's spots)
- Skin: description of rash or petechiae (for more information, see *FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 16 – Skin*)
- Joints: swelling and mobility
- Ana excoriation in diarrheal illness

Palpation

- Fontanel (in infants): size, consistency
- Neck rigidity
- Tactile characteristics of rash
- Lymphadenopathy
- Hepatosplenomegaly
- Joint movement
- Skin turgor and hydration

Auscultation (Heart and Lungs)

- Breath sounds
- Crackles
- Wheezing
- Stridor
- Heart sounds
- Pleural or pericardial rubs
- Murmurs

**COMMUNICABLE
EXANTHEMS (RASH)**

A communicable exanthema is a rash that “bursts forth or blooms” in association with some infections. It is characteristically widespread, symmetrically distributed on the child’s body and consists of red, discrete or confluent flat spots (macules) and bumps (papules) that (at least at first) are not scaly.

Diseases that begin with an exanthem or rash may be caused by bacteria, viruses or reactions to drugs.

Some exanthems are accompanied by oral lesions, the most well known of which are the Koplik spots of measles and the oral lesions found in hand-foot-and-mouth disease.

Many viral infections of childhood are characterized by a rash occurring toward the end of the disease course. Often, the rash starts on the head and progresses down the body and out onto the extremities. About the time the rash appears, the fever associated with the infection usually disappears and the child starts to feel a lot better. Several viral illnesses are associated with rashes that are reliable for diagnosis (e.g., measles, rubella, erythema infectiosum, roseola infantum, and chickenpox), but the rashes of most viral illnesses are too variable to allow accurate diagnosis. That is why health care professionals often tell the client, “It’s a virus.” A thorough history and physical exam are very important to rule out more serious causes of the rash.

CHICKENPOX (VARICELLA)

OVERVIEW

Please refer to provincial/territorial guidelines for Chickenpox (Varicella) where available.

Chickenpox (Varicella) is a primary infection caused by varicella-zoster virus (VZV) and is considered to be self-limiting in otherwise healthy children.⁽¹⁾ Varicella varies in severity; it may be very mild with just a few spots, or severe and accompanied by fever and a widespread rash.⁽²⁾ In general, risk of severe varicella infection increases with age.⁽¹⁾ Varicella-zoster is a vaccine preventable disease.⁽²⁾

CAUSES

Varicella-zoster virus (VZV)⁽²⁾

TRANSMISSION

- Person-to-person: by airborne spread from respiratory tract or direct contact with fluid in the skin lesions⁽²⁾

INCUBATION PERIOD

Children

- 10-21 days⁽¹⁾

Infants born to mothers with active varicella around the time of delivery

- 2-16 days after birth⁽³⁾

COMMUNICABILITY

Very contagious; infectiousness begins 1 to 2 days before onset of rash and remains until last lesion has crusted⁽²⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

Varicella-susceptible individuals are at risk for contracting varicella-zoster when exposed to an individual who:

- Is contagious with the varicella-zoster virus
- Has herpes zoster (shingles), which is a member of the herpesvirus family; results from reactivation of latent VZV⁽⁴⁾

The following susceptible groups are at greater risk for complications or severe varicella disease:⁽¹⁾

- Adolescents and adults
- Immunocompromised individuals
- Pregnant women
- Fetuses exposed to maternal varicella disease in first 20 weeks of pregnancy are at risk for congenital varicella syndrome by transplacental infection
- Neonates are at greater risk if the mother's varicella-zoster rash appears between 5 days before and 2 days after birth.^(5; 6)

For more information on the risks associated with varicella disease, see *Table 1: Varicella Post-exposure Management for Susceptible* Individuals* in *Appendix, Section A* of this guideline.

HISTORY OF PRESENT ILLNESS

- Review risk factors and collect history of present illness.
- Obtain a history of exposure and immunization history (i.e., completion of 2-dose varicella-zoster vaccine immunization regimen).
- Low-grade fever, followed by mild symptoms (e.g., headache, runny nose, general feeling of malaise)⁽²⁾
- A rash that is usually first noted on the scalp, then on extremities and trunk⁽⁴⁾
- A rapidly progressing, generalized and pruritic rash⁽⁴⁾

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Low-grade fever, rhinorrhea⁽²⁾
- Vesicular rash/skin lesions that:
 - Are in various stages of development⁽⁴⁾
 - Progress rapidly from macules to papules to vesicular lesions before crusting⁽⁴⁾
 - May rupture or become purulent before they dry and crust⁽⁴⁾
 - Appear in successive crops over several days⁽⁴⁾
- Lesions:
 - Where the highest concentration is on the trunk⁽⁴⁾
 - That appear on the mucous membranes of oropharynx, respiratory tract, vagina, conjunctiva, and cornea⁽⁴⁾
 - That are 1 to 4 millimeters in diameter⁽⁴⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Disseminated herpes simplex virus infection⁽⁷⁾
- Enterovirus⁽⁷⁾
- Psoriasis⁽⁷⁾
- Stevens-Johnson syndrome (associated with history of medication use - most

commonly anticonvulsants, antibiotics, and nonsteroidal anti-inflammatory drugs)⁽⁷⁾

- Syphilis in neonates (can present with a blistering rash at birth)⁽⁷⁾

COMPLICATIONS

Complications are more common in adolescents, adults and immunocompromised people.⁽¹⁾

- Secondary bacterial skin and soft tissue infections
- Severe invasive group A streptococcal infection (GAS) (varicella increases the risk of invasive GAS infection in previously healthy children by 40-60 fold. GAS includes necrotizing fasciitis and toxic shock syndrome.)
- Bacteremia
- Pneumonia
- Osteomyelitis
- Septic arthritis
- Cerebellar ataxia
- Stroke
- Encephalitis

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.

- Varicella infection is usually a clinical diagnosis. Diagnostic testing is not necessary in a client with typical presentation. Lab investigations should be considered in the following situations:
 - Atypical rash in an immunocompromised host

- Possible disseminated disease in an immunosuppressed host without cutaneous lesions⁽⁸⁾
- Source specimens may include vesicular fluids, vesicular lesions, and respiratory secretions (if pulmonary infiltrates)⁽⁹⁾
- The test commonly ordered to confirm diagnosis of VZV is virus culture.⁽⁹⁾
- If available, rapid diagnostic tests such as direct fluorescent antibody (DFA) or PCR may be ordered in consultation with a physician/nurse practitioner.⁽⁸⁾
- Pregnant women and immunocompromised individuals exposed to varicella should be evaluated for a history of varicella vaccination or disease.
 - In the absence of a history, immunity should be assessed by serologic testing (IgG) as soon as possible.⁽¹⁾
- Washing or disinfecting articles that may have been soiled by vesicle fluid or by discharge from nose or throat⁽²⁾
- Keeping the child away from child centre, school or public places unless:
 - The varicella infection is mild (e.g., producing a low fever for a short time, rash with less than 30 spots)⁽¹¹⁾
 - The last lesions have scabbed over⁽²⁾
 - The child feels well enough to participate in all activities
 - The child's return is approved by the child centre or school
- Ways to help control itching:
 - Use of an oatmeal bath product or add half a cup of baking soda to the bathwater⁽¹⁰⁾
 - Apply calamine lotion to the blisters⁽¹⁰⁾
 - Take a prescribed antihistamine to help relieve the itching⁽¹⁰⁾
 - The client should not receive any acetylsalicylic acid (ASA) or products that contain ASA. Taking ASA increases the risk of getting Reye's syndrome, which can damage the liver and brain⁽¹¹⁾.
 - Counsel parent(s)/caregiver(s)/client about appropriate use of medications; dose, frequency, importance of adherence, potential side effects and interactions.

For more information on post-exposure serological testing, see *Table 1: Varicella Post-exposure Management for Susceptible* Individuals in Appendix, Section A* of this guideline.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Provide supportive care
- Relieve symptoms
- Prevent disease transmission
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Client Education

- Counsel parent(s)/caregiver(s)/client on:
 - How to provide comfort and prevent spread of infection
 - When to follow-up at the nursing station
 - The importance of trimming fingernails to prevent scratching and infection⁽¹⁰⁾

For more information on caring for a child with chickenpox, see the Canadian Paediatric Society's *CaringforKids – Chickenpox*, available from: <http://www.caringforkids.cps.ca/handouts/chickenpox>

Prevention During Pregnancy

- Pregnant clients who have not had chickenpox or who are known to be seronegative for chickenpox should be advised to:
 - Avoid contact with anyone with chickenpox and shingles during pregnancy
 - Inform healthcare workers of a potential exposure without delay⁽¹²⁾

For more information on preventing infection, see *Prevention in Appendix, Section A* of this guideline.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary before initiating treatment.

Analgesic/Antipyretic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness.^(13; 14) Consult with physician/nurse practitioner - particularly for children less than 3 months of age.

Acetaminophen^(15; 16)

- Acetaminophen 10 to 15 mg/kg/dose PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg in 24 hours or 4,000 mg in 24 hours, whichever is less

Ibuprofen⁽²⁴⁾

Infants <6 months

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

*Maximum from all sources for all ages: Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours, whichever is less. Under physician/nurse practitioner supervision, daily doses $\leq 2,400$ mg may be used.

Antihistamine/Antipruritic^(17; 18; 25)

- Limited evidence is found to support the use of systemic antihistamines.
- Benefits must be weighed against potential risks.⁽¹⁹⁾

- One of the antihistamines listed may be considered for the management of pruritis.

Note: DiphenhydrAMINE may cause sedation or paradoxical excitement in children.

DiphenhydrAMINE

Weight-directed dosing

- 5 mg/kg/day divided into 3-4 doses
- Maximum daily dose: 300 mg/day

Dosage by age

2 Years to Less than 6 Years of Age

- DiphenhydrAMINE (Benadryl®) 6.25 mg PO q4-6h PRN
- Maximum: 37.5 mg in 24 hours

6 Years to Less than 12 Years of Age

- DiphenhydrAMINE (Benadryl®) 12.5 to 25 mg PO q4-6h PRN
- Maximum 150 mg in 24 hours

12 Years of Age or Greater

- DiphenhydrAMINE (Benadryl®) 25 to 50 mg PO q4-6h PRN
- Maximum 300 mg in 24 hours

Cetirizine

2 Years to 5 Years of Age

- Cetirizine 2.5 mg PO once daily PRN
- Maximum dose of 2.5 mg BID or 5 mg once daily

6 Years of Age or Greater

- Cetirizine 5 to 10 mg PO once daily PRN
- Maximum 10 mg in 24 hours

Antiviral

Healthy, immunocompetent children with varicella under the age of 12

- Oral antiviral therapy is not routinely recommended for otherwise healthy immunocompetent children with varicella under the age of 12.⁽²⁶⁾

- However, if the immunocompetent individual is at increased risk for moderate to severe varicella complications, then oral antiviral therapy may be considered.
- For recommended treatments for this population, see *Acyclovir Recommendations for Immunocompetent Individuals at Risk of Moderate to Severe Varicella* in *Appendix, Section A* of this guideline.

Immunocompromised clients with severe varicella

- An immunocompromised client with severe varicella requires IV acyclovir and medical evacuation.^(20; 21)

When to start acyclovir⁽²⁶⁾

- Acyclovir should be started within 24 hours after the rash develops, if possible. In addition, in immunocompetent hosts, viral replication typically stops by 72 hours after the onset of rash.

Consult physician/nurse practitioner.

Post-exposure Management

Varicella Vaccine⁽¹⁾

- Univalent varicella vaccine - given as soon as possible and within 3 and up to 5 days after exposure - has been shown to be approximately 90% effective in preventing or reducing the severity of varicella. It is the post-exposure management of choice for susceptible, healthy, non-pregnant individuals.

Healthy infants less than 12 months of age

- Varicella vaccination is not indicated for post-exposure management of healthy infants less than 12 months of age as they are generally protected by maternal antibodies.

Individuals under 50 years of age

- If they have received only 1 dose of varicella-containing vaccine, they should be offered a second dose⁽¹⁾

Varicella Zoster Immune Globulin (VarIg)⁽²²⁾

- VarIg may be recommended for certain susceptible groups for the prevention or reduction in severity of infection within 4 days (96 hours) of the most recent exposure to the varicella zoster virus.
- The protection conferred by VarIg lasts approximately 3 weeks. Subsequent exposures occurring more than 3 weeks after a dose of VarIg will require additional doses if the criteria for administration are met.
- The decision to administer VarIg should be based on fulfilling **all** of the following 4 criteria:
 1. The exposed person is susceptible to varicella. For more information on susceptibility and immunity, see *Appendix, Section A* of this guideline.
 2. There has been significant exposure to a person with varicella or Herpes Zoster (HZ). For the definition of 'significant exposure' to VZV, see *Appendix, Section A* of this guideline.

3. The exposed person is at increased risk of severe varicella. For a description of individuals at increased risk of severe varicella, see *Appendix, Section A* of this guideline.
4. Post-exposure immunization with univalent varicella vaccine is contraindicated.
 - Consult with a Public Health Physician if VarIg is required.
 - VarIg is usually provided as a single IM dose.
 - Arrangement to transfer the client out to receive the treatment may be necessary.
 - For more information on the criteria for VarIg administration, see *Canadian Immunization Guide – Part 5 – Passive immunizing agents*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/p05-01-eng.php>
 - For the VariZIG drug monograph, see active ingredient ‘*Varicella*’ in the *Health Canada Drug Product Database*, available from: <https://health-products.canada.ca/dpd-bdpp/index-eng.jsp>.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- Monitor vital signs as indicated by client’s condition.
- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

- Arrange follow-up appointment for client to be assessed in 1 week.
- Advise the parent(s)/caregiver(s) to bring client back to the clinic for further assessment if there is no improvement in signs and symptoms of presenting condition or if any complications arise.

- If a close contact’s immunization status is incomplete, vaccination against varicella should be arranged.
- Monitor for other cases of varicella in the community.

Referral

- Not usually necessary unless complications are present or the client is pregnant or immunocompromised
- Arrange for medical evacuation if clinically indicated.
- Coordinate referral requested as required.

Reporting

- Suspected and confirmed cases are to be reported to the provincial/territorial Public Health Physician as per provincial/territorial policy/procedure.
- Varicella occurring 7 to 21 days after vaccination with varicella-containing vaccine that is moderate (50 to 500 lesions) or severe (more than 500 vesicular lesions/associated complications/hospital admission) is considered an adverse event following immunization and is reportable to the provincial/territorial MOH.⁽¹⁾

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Susceptibility and Immunity⁽¹⁾

Individuals born before 2004

- In individuals born before 2004 (with the exception of health care workers), a self-reported history of varicella is considered a reliable history of varicella disease.

Children born in 2004 or later (or health care workers)

- A health care provider diagnosis of varicella or herpes zoster is necessary to be considered a reliable history of varicella disease.⁽¹⁾

Individuals considered immune to varicella will have one or more of the following:

- **Born before 2004 (except for health care workers)**
A self-reported history of varicella
- **Born in 2004 or later (or health care workers)**
A health care provider diagnosis of varicella or herpes zoster is required.
- Documented evidence of immunization with 2 doses of a varicella-containing vaccine
- A history of laboratory confirmed varicella infection
- Laboratory evidence of immunity

Individuals who do not have ANY of the above are considered susceptible to varicella.

Recipients of hematopoietic stem cell transplant (HSCT) should be considered susceptible in the post-transplantation period - regardless of a history of varicella disease or vaccination, or positive serologic test results.

Significant Exposures to Varicella Zoster⁽¹⁾

The following situations are considered significant exposures to VZV as result of contact with a person with varicella:

- Continuous household contact (that is living in the same dwelling) with a person with varicella
- Being indoors for more than 1 hour with a person with varicella
- Being in the same hospital room for more than 1 hour, or having more than 15 minutes of face-to-face contact with a person with varicella
- Touching the lesions or articles freshly soiled by vesicle discharge from a person with active varicella

The following situations are considered significant exposures to VZV as result of contact with a person with Herpes Zoster (HZ):

- Continuous household contact (that is living in the same dwelling) with an immunocompromised person with HZ or a person with disseminated HZ prior to or within first 24 hours of antiviral treatment.
- Being indoors for more than 1 hour with an immunocompromised person with HZ or a person with disseminated HZ prior to or within first 24 hours of antiviral treatment
- Being in the same hospital room for more than 1 hour, or more than 15 minutes of face-to-face contact with an immunocompromised person with HZ or a person with disseminated HZ prior to or within first 24 hours of antiviral treatment
- Touching the lesions or articles freshly soiled by vesicle discharge from a person with active HZ

Persons at Increased Risk for Severe Varicella

The following individuals are at increased risk for severe varicella:

- Those who touch the lesions or articles of clothing freshly soiled by vesicle discharge from a person with active HZ
- Newborn infants of mothers who develop varicella from 5 days before until 48 hours after delivery
- Neonates in intensive care settings born at less than 28 weeks of gestation or weighing 1,000 g or less at birth, regardless of their mothers' evidence of immunity
- Susceptible pregnant women
- Susceptible immunocompromised persons, including HIV-infected persons with CD4 cell count $<200 \times 10^6/L$ or CD4 percentage $<15\%$

Recipients of hematopoietic stem cell transplantation (HSCT) should be considered susceptible in the post-transplantation period, regardless of pre-transplant varicella immune status or post-transplant immunization history – including varicella disease, vaccination or positive serologic test results.

TABLE 1Varicella Post-exposure Management for Susceptible* Individuals⁽¹⁾

POST-EXPOSURE INTERVENTION	HEALTHY, NON-PREGNANT INDIVIDUAL**	PREGNANT INDIVIDUAL	IMMUNOCOMPROMISED INDIVIDUAL****
Vaccinate with varicella vaccine	Yes	No	No
Collect sample for VZV IgG	No	Yes	Yes
If VZV IgG is negative, administer varicella-zoster immune globulin***	Not applicable	Yes	Yes
* Refer to Susceptibility and Immunity			
** Refer to VarIg or information regarding newborns of mothers who develop varicella during the 5 days before to 48 hours after delivery.			
*** If serology results cannot be obtained within 96 hours, administer varicella-zoster immune globulin			
**** In case of hematopoietic stem cell transplant (HSCT), administer VarIg regardless of VZV IgG result			

Referenced from Canadian Immunization Guide – Part 4 – Active vaccines – Varicella (Chickenpox vaccine) *Table 2: Varicella Post-exposure Management for Susceptible* Individuals* at: www.phac-aspc.gc.ca/publicat/cig-gci/p04-vari-eng.php

For more information about varicella vaccine, see the following:

- *Canadian Immunization Guide – Part 4 – Active vaccines – Varicella (Chickenpox vaccine)*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/p04-vari-eng.php>
- *Canadian Immunization Guide – Part 3 – Vaccinations in special populations*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/p03-eng.php>
- *Canadian Immunization Guide – Part 5 – Passive immunizing agents*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/p05-01-eng.php>

Specific Population: Pregnancy

- Consult physician/nurse practitioner for further guidance when a pregnant woman has been exposed to varicella.
- Pregnant women exposed to varicella should be evaluated for a history of varicella vaccination or disease. In the absence of such a history, immunity should be assessed by serologic testing (Varicella-zoster IgG).⁽¹⁾

- If the serum results are negative or unavailable within 96 hours from exposure, Varicella-zoster immune globulin (VarIg) should be administered.⁽⁵⁾
- Varicella vaccine is contraindicated in pregnant women.⁽⁵⁾
- **Note:** Susceptible women should receive varicella vaccination post-delivery within the appropriate time interval (at least 5 months after VarIg was given to avoid reduced vaccine efficacy from shorter intervals).⁽¹⁾
- Women with varicella infection during pregnancy are at risk of potential adverse maternal and fetal sequelae, including maternal pneumonitis and congenital malformations.⁽⁵⁾ Consult physician/nurse practitioner for obstetrician/gynecologist consultation.

Acyclovir Recommendations for Immunocompetent Individuals at Risk for Moderate to Severe Varicella

- Acyclovir has been shown to inhibit viral replication.⁽⁹⁾
- Oral acyclovir is not recommended for routine use in otherwise healthy children with varicella. However, it should be considered for individuals at increased risk of moderate to severe varicella; for example:
 - Unvaccinated individuals older than 12 years of age⁽³⁾
 - Individuals who have chronic cutaneous or pulmonary disorders⁽³⁾
 - Individuals who are receiving long-term salicylate therapy⁽³⁾
 - Individuals who are receiving short, intermittent, or aerosolized courses of corticosteroids⁽³⁾
 - Pregnant women with significant varicella infection (if there is progression to varicella pneumonitis, hospital admission and IV acyclovir is recommended)⁽⁵⁾
- Some experts also recommend use of oral acyclovir for secondary household cases in which the disease is usually more severe than in the primary case.⁽³⁾

Note: If acyclovir suspension is not available, the acyclovir tablets can be cut to administer more accurate dosing. Tablets can be crushed for child who cannot swallow tablets.

- IV acyclovir is used for individuals with severe VZV infection or those at risk of developing serious infection.⁽⁹⁾

Prevention

- A 2-dose primary schedule for children is recommended to improve varicella control and to decrease breakthrough cases.
 - The first dose should be between 12 and 15 months of age, and
 - The second dose at 18 months of age or any time thereafter but no later than school entry. Can be given as a combined vaccine with MMR.⁽¹⁾

- Children with a clinician-diagnosed or verified history of typical chickenpox can be assumed to be immune to varicella.
- Several vaccine products containing a live attenuated strain of varicella virus are licensed in Canada (e.g., Varivax III⁽²³⁾).

For more information on varicella vaccines, see the *Regional Immunization Manual* and the latest *Canadian Immunization Guide* for varicella vaccines, available at: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-24-varicella-chickenpox-vaccine.html>

Breakthrough Varicella

- Subclinical varicella infection has been known to occur post-immunization.^(3; 4)

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The following references and other sources have informed the updating of this Clinical Practice Guideline.

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DIPHTHERIA

OVERVIEW

Please refer to provincial/territorial guidelines for Diphtheria where available.

Diphtheria is an acute, toxin-mediated infectious disease that affects mucous membranes (primarily those of the upper respiratory tract) and the skin. The most common sites of diphtheria infection are the pharynx and the tonsils.⁽¹⁾

Diphtheria is a vaccine-preventable disease. Due to routine immunization programs, diphtheria is rare in developed countries, although cases that are observed tend to be more serious. Because unfamiliarity with the disease can lead to delays in diagnosis and treatment,⁽²⁾ such cases may be fatal.

Consult with physician/nurse practitioner immediately when there is suspicion of diphtheria as it may require urgent medical evacuation.

CAUSES

Corynebacterium diphtheriae (*C. diphtheriae*) bacteria⁽³⁾

TRANSMISSION

- Occurs primarily through the spread of respiratory droplets from infected cases or carriers⁽³⁾
- Contact with articles contaminated by secretions of infected people⁽³⁾

INCUBATION PERIOD

1 to 10 days⁽³⁾

COMMUNICABILITY

- The infectious period in untreated individuals is usually 2 weeks or less and rarely more than 4 weeks⁽³⁾
- Bacterial shedding usually stops within 48 hours of antibiotics⁽³⁾
- Bacterial shedding from cutaneous infections continues longer than from the respiratory tract.⁽⁵⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Children and adults who do not have up-to-date immunizations and who are exposed to people with diphtheria.
- Social risk factors:
 - Poor skin care and hygiene
 - Unimmunized clients living in crowded, unsanitary, or impoverished conditions and who are exposed to people with diphtheria
 - Cutaneous diphtheria is often associated with overcrowding, impoverished groups and homeless persons⁽⁵⁾

HISTORY OF PRESENT ILLNESS

- Review risk factors and collect history of present illness.
- Review immunization history.
- Diphtheria infection can involve almost any mucous membrane. For clinical purposes, diphtheria may be classified according to the anatomic site of disease.⁽¹⁾

Anterior Nasal Diphtheria⁽¹⁾

- Onset is indistinguishable from that of the common cold and is usually characterized by a mucopurulent nasal discharge which may become blood-tinged.

Pharyngeal and Tonsillar Diphtheria⁽¹⁾

- The onset of pharyngitis is insidious; early symptoms include malaise, sore throat, anorexia, and low-grade fever.

Laryngeal Diphtheria⁽¹⁾

- Symptoms include fever, hoarseness and a barking cough.

Cutaneous Diphtheria⁽¹⁾

- May be manifested by rash or by ulcers.

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Fever (usually low grade)⁽¹⁾
- Client appears quite toxic/acutely ill⁽¹⁾
- Mucopurulent nasal discharge which may become blood-tinged⁽¹⁾
- Adherent nasal and/or pharyngeal membrane. Membrane can be white, bluish-white, greyish-green or black if bleeding has occurred⁽¹⁾
- The pseudomembrane is firmly adherent to the tissue⁽¹⁾
- Minimal amount of mucosal erythema surrounding the membrane⁽¹⁾
- Extensive pseudomembrane formation may result in respiratory obstruction⁽¹⁾
- The client with severe disease may develop marked edema of the submandibular areas and the anterior neck, along with lymphadenopathy, giving a characteristic “bull neck” appearance.⁽¹⁾
- Cough, hoarseness⁽¹⁾
- Stridor⁽⁸⁾
- Respiratory distress⁽³⁾
- Cutaneous diphtheria is characterized by a scaling rash or non-healing ulcers with clearly demarcated edges and membrane⁽¹⁾

- Cutaneous lesions may resemble impetigo⁽³⁾
- Late effects of absorbed toxin, appearing after 2 to 6 weeks, include myocarditis and neuropathy⁽⁴⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Bacterial and viral pharyngitis⁽⁸⁾
- Epiglottitis⁽⁸⁾
- Vincent’s angina (a unique and dramatic form of gingivitis characterized by painful, inflamed gingiva with ulcerations of the interdental papillae that bleed easily)⁽⁹⁾
- Infectious mononucleosis⁽⁸⁾
- Oral syphilis⁽⁴⁾
- Oropharyngeal candidiasis⁽⁸⁾

COMPLICATIONS

- Myocarditis (may present as abnormal cardiac rhythms and can occur early in the course of the illness or weeks later, and can lead to heart failure. If myocarditis occurs early, it is often fatal).⁽¹⁾
- Neuritis (most often affects motor nerves and usually resolves completely)
- Paralysis of the soft palate (most frequent during the third week of illness)
- Paralysis of the muscles, limbs and diaphragm (can occur after the 5th week)⁽¹⁾
- Secondary pneumonia and respiratory failure may result from diaphragmatic paralysis⁽¹⁾
- Otitis media and respiratory insufficiency due to airway obstruction, especially in infants⁽¹⁾
- Coma⁽¹⁾
- Death⁽¹⁾

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Presumptive Diagnosis

- Presumptive diagnosis for diphtheria is made clinically because prompt treatment is essential.⁽¹⁾
- Presumptive diagnosis may include observation of a greyish-white, grey or black membrane, especially if extending to the uvula and soft palate, in association with tonsillitis, pharyngitis or cervical lymphadenopathy, or a serosanguinous nasal discharge.⁽⁴⁾

Laboratory

- Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.
- Throat and/or nasopharyngeal swabs of the lesions for culture and sensitivity (C+S) to confirm diagnosis⁽¹⁾
- Culture of cutaneous lesions⁽¹⁾

Sample Collection

- For pharyngeal samples, ensure that any discoloured areas, ulcerations and tonsillar crypts are swabbed.⁽¹⁾
- For cutaneous samples:
 - Material should be taken from the affected area of the skin, either by aspirate or swab.
 - Membranous material may also be cultured.
 - Remove any crusted material and swab the base of the lesion(s).
- Diphtheria is primarily a respiratory infection; however specimens should be collected from suspect skin lesion(s) during the acute phase of illness.⁽⁷⁾

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Prevent complications
- Prevent disease transmission to others

NON-PHARMACOLOGICAL INTERVENTIONS

Interventions

- Monitor vital signs
- Provide oxygen and maintain client's airway PRN as per policies and procedures
- NPO as clinically indicated

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/ nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/ territorial formulary before initiating treatment.

IV Therapy

- Start IV therapy with IV fluid such as 0.9% sodium chloride, and run at a rate sufficient to maintain hydration.

For more information, see *FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 4 – Fluid Management*.

Antibiotic therapy

- Antibiotics may be initiated before transfer, but only in consultation with the public health physician.
- For antibiotic management of contacts and carriers, see *Prevention* in *Appendix, Section A* of this guideline. Consult with a public health physician.

Diphtheria Antitoxin

- If diphtheria antitoxin is required:
 - Consult with a Public Health Physician.
 - Arrange for medical evacuation as soon as possible.

Note: Currently there is no licensed product made in Canada. An anti-diphtheria serum is available from Health Canada's Special Access Program (SAP).⁽⁶⁾ Follow provincial/territorial public health as per policies and procedures.

For additional information regarding diphtheria antitoxin, see Canadian Immunization Guide – Part 5 – Passive Immunization, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/p05-01-eng.php>

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- Monitor vital signs as clinically indicated
- Monitor respiratory status
- Monitor neurological status
- Monitor intake and output
- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

Referral

Arrange for medical evacuation if clinically indicated.

Reporting

Diphtheria is a reportable disease. Follow provincial/territorial policies and procedures for notifiable diseases.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Prevention

- Diphtheria toxoid given as diphtheria-combination vaccine according to recommended immunization schedule in your jurisdiction; for more information, see the latest *Canadian Immunization Guide*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php>

For more information on ways to prevent diphtheria, see *Diphtheria – Prevention*, available from: <http://www.phac-aspc.gc.ca/im/vpd-mev/diphtheria-diphtherie/prevention-eng.php>

Contact Management

- Consult with local public health physician to determine management of contacts.
- Contacts are defined as:
 - Household members
 - Persons who have had close face-to-face contact to a case such as intimate contact
 - Someone who shares the same room at home, school or work
 - Health care workers exposed to oropharyngeal secretions from the case⁽⁷⁾
- Check immunization histories of case/carrier and close contacts.⁽⁴⁾

Close contacts

- Close contacts of a diphtheria case should receive an age-appropriate dose of a diphtheria toxoid-containing vaccine unless:⁽²⁾
 - The contact is known to have been fully immunized and
 - The last dose of diphtheria toxoid-containing vaccine was administered within the last 10 years
- The diphtheria toxoid-containing vaccine series should be completed for previously unimmunized or incompletely immunized contacts.⁽²⁾
- Close contacts also need to be cultured and treated with antimicrobial prophylaxis.⁽⁸⁾

Antibiotic treatment options for close contacts⁽¹⁰⁾:**Benzathine penicillin G****Children <6 years of age**

- Benzathine penicillin G 600,000 units intramuscularly (IM)

Children >6 years of age

- Benzathine penicillin G 1.2 million units IM

Benzathine penicillin G may be obtained through the Non-Insured Health Benefits Program, if not available through provincial/territorial formulary. It is not listed in the FNIHB Nursing Station Formulary.

or

Erythromycin

- Erythromycin 500 mg 4 times daily for 7 to 10 days

Note: For adherence reasons, if surveillance of contacts cannot be maintained, they should receive benzathine penicillin G.

Diphtheria antitoxin

- Diphtheria antitoxin is not recommended for post-exposure prophylaxis in asymptomatic contacts.
- Contacts should be closely monitored and antitoxin given at the first sign(s) of illness.
- All identified contacts should be alerted to signs and symptoms of diphtheria and advised to seek medical attention immediately should they develop any clinical manifestations of diphtheria.⁽⁷⁾

Home isolation

Home isolation for the following contacts is indicated until treatment is complete and cultures from the nose and throat or lesions are negative.⁽⁷⁾

- Contacts who attend school
- Contacts whose occupations involve:
 - Food handling
 - Close contact with children under 7 years of age
 - Known unimmunized persons
 - Care of the sick

Carriers

Identified carriers in the community should also receive antibiotics. Carriers may be treated with erythromycin.

SECTION B: SUPPLEMENTAL RESOURCES**Provincial/Territorial Guidelines****Alberta**

Alberta Health and Wellness
Public Health Notifiable Disease Management Guidelines: Diphtheria. Available from: <http://www.health.alberta.ca/professionals/notifiable-diseases-guide.html>

British Columbia

BC Centre for Disease Control
Diseases & Conditions: Diphtheria. Available from: <http://www.bccdc.ca/health-info/diseases-conditions/diphtheria>

Manitoba

Public Health and Primary Health Care
Communicable Disease Management Protocols: Diphtheria. Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/>

Newfoundland and Labrador

Department of Health and Community Services
Newfoundland and Labrador Disease Control Manual: Disease Control Manual: Section 4, Diseases Preventable by Routine Vaccination – Diphtheria. Available from: http://www.health.gov.nl.ca/health/publications/diseasecontrol/s4_diseases_preventable_by_routine_vaccination.pdf

Northwest Territories

Northwest Territories Health and Social Services
Communicable Disease Manual: Diphtheria. Available from: <http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Nova Scotia

Health and Wellness
Communicable Disease Manual: Diphtheria. Available from: <http://www.novascotia.ca/dhw/cdpc/cdc/>

Ontario

Ontario Ministry of Health and Long-Term Care Diseases and Conditions: Diphtheria. Available from: <http://www.health.gov.on.ca/en/pro/publications/disease/diphtheria.aspx>

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ERYTHEMA INFECTIOSUM (FIFTH DISEASE)

OVERVIEW

Please refer to provincial/territorial guidelines for Erythema Infectiosum (Fifth Disease) where available.

Erythema Infectiosum (Fifth Disease) is a primarily benign childhood illness characterized by erythema of the cheeks (slapped-cheek appearance). It is highly contagious.⁽¹⁾

CAUSES

Human parvovirus B19⁽¹⁾

TRANSMISSION

- Contact with respiratory secretions⁽¹⁾
- Percutaneous exposure to blood or blood products⁽¹⁾
- Vertical transmission from mother to fetus^(1;2)

INCUBATION PERIOD

4 to 21 days⁽¹⁾

COMMUNICABILITY

Most communicable before the onset of the rash⁽¹⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- School-age children⁽¹⁾
- History of close contact with individuals infected with parvovirus B19⁽¹⁾
- Individuals who are immunocompromised⁽¹⁾

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

- Obtain a history of exposure and a complete medical history to determine if client or other household members :
 - have immunocompromised condition⁽⁴⁾
 - have anemia disorder⁽⁴⁾
 - are pregnant⁽⁴⁾
- Immunocompromised individuals may have an atypical rash, or may not have manifestations of rash.⁽¹⁾

Prodromal Stage

- The prodromal stage often precedes the characteristic exanthem by approximately 7 to 10 days.⁽¹⁾ The following may be reported by the parent(s)/caregiver(s)/client:
 - Fever⁽¹⁾
 - Coryza/rhinorrhea⁽⁴⁾
 - Headache⁽¹⁾
 - Malaise⁽¹⁾
 - Myalgia⁽¹⁾
 - Nausea⁽⁴⁾
 - Diarrhea⁽⁴⁾
 - Arthralgia⁽¹⁾
 - Itchy rash⁽¹⁾

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Exanthem⁽¹⁾
- Intensely red ‘slapped cheek’ appearance:
 - Presents in the initial stage of the rash (often has a circumoral pallor)

- Is often followed by symmetric, macular, and lace-like trunk lesions which may spread to involve arms, buttocks, and thighs
- May last weeks or months
- May fluctuate in intensity and recur with environmental changes (e.g., exposure to sunlight, change in temperature)
- Arthritis:⁽⁴⁾
 - Most frequently involves the small joints of the hands, wrists, knees and feet
 - Less common in children than adults
 - Usually acute and symmetrical

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Other viral exanthems⁽⁴⁾
- Group A streptococcal infection⁽⁴⁾
- Enteroviral infections⁽⁴⁾
- Infectious mononucleosis⁽⁴⁾
- Acute human immunodeficiency virus (HIV)⁽⁴⁾
- Allergic rash⁽⁴⁾
- Rheumatoid arthritis⁽⁵⁾

COMPLICATIONS

- Transient aplastic crisis (severe anemia) in children with hematologic abnormalities or immunocompromise^(4; 6)

Complication of Parvovirus B19 Infection in Pregnancy^(2; 4)

- Miscarriage
- Spontaneous fetal loss
- Fetal hydrops

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.

- If the client is otherwise healthy, the diagnosis is clinical and no lab investigations are required.⁽⁴⁾
- If complications are present or client is at risk of complications (e.g., client is pregnant, immunocompromised, or has an anemic disorder), lab investigations are recommended.
 - CBC, Reticulocyte count if client has anemia disorder, is immunocompromised or pregnant⁽⁴⁾
 - Serology for Parvovirus B19 IgM, IgG antibodies⁽²⁾

Ultrasound

- Obstetrical ultrasound may be considered. For more information on erythema infectiosum in pregnant clients, see *Special Population: Pregnant Clients* in Appendix, Section A of this guideline.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Provide supportive care
- Prevent transmission, especially to those who are pregnant, immunocompromised or have an anemia disorder^(2; 3)
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Client Education

- The virus spreads via nasopharyngeal droplet secretions.⁽⁷⁾
- The condition is most infectious before the onset of symptoms but is unlikely to be contagious after the development of the rash and other symptoms.
- Advise clients at risk of complications to avoid contact with those infected with this condition.
- Encourage fluids in adequate amounts to maintain hydration.
- Washing hands frequently and proper disposal of used facial tissues will help prevent the spread of the infection.^(1; 7; 8)
- Avoid excessive heat and sunlight and scratching as these can make the rash worse.^(1; 7)
- Otherwise healthy children do not need to be isolated or restricted from school or daycare after the rash appears.⁽¹⁾
- The client should not receive any acetylsalicylic acid (ASA) or products that contain ASA. Taking ASA increases the risk of getting Reye's syndrome which can damage the liver and brain.⁽⁹⁾
- Counsel parent(s)/caregiver(s)/client about appropriate use of medications; dose, frequency, importance of adherence, potential side effects and interactions.
- For more information for parent(s)/caregiver(s), see:
 - HealthLinkBC's *Fifth Disease; Parvovirus Infection*. available from: <http://www.healthlinkbc.ca/healthfiles/hfile54.stm> and
 - The Canadian Paediatric Society's *CaringforKids – Fifth Disease (Erythema Infectiosum)*, available from: http://www.caringforkids.cps.ca/handouts/fifth_disease.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary before initiating treatment.

Analgesic/Antipyretic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen^(10; 11)

- Acetaminophen 10 to 15 mg/kg/dose PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg in 24 hours or 4,000 mg in 24 hours, whichever is less

Ibuprofen⁽¹²⁾

Infants <6 months

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*

*Maximum from all sources for all ages:

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours, whichever is less. Under physician/nurse practitioner supervision, daily doses ≤2,400 mg may be used.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- Monitor vital signs as indicated by client's condition.
- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

Follow-up should occur if complications develop or symptoms do not resolve in expected period of time (usually up to 20 days).

Referral

Not usually required, unless client is pregnant, immunocompromised or has an anemia disorder.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Special Population: Pregnant Clients

- Approximately 50–75% of females of reproductive age have developed immunity to parvovirus B19.⁽²⁾
- About 1–3% of susceptible pregnant females will develop serologic evidence of infection in pregnancy, rising to over 10% in epidemic periods.⁽²⁾
- Up to 70% of infected pregnant females will be asymptomatic.⁽²⁾
- If a recent parvovirus B19 infection has been diagnosed, referral to an obstetrician or a maternal-fetal medicine specialist is recommended.⁽²⁾
- The client should be followed by an obstetrician or a maternal-fetal medicine specialist for counselling regarding risks of fetal transmission, fetal loss, and hydrops.

- Serial ultrasounds should be performed every 1 to 2 weeks, up to 12 weeks after infection, to detect the development of anemia and hydrops (using Doppler measurement of the middle cerebral artery peak systolic velocity).⁽²⁾

For more information about pregnancy and Parvovirus B19, see the Society of Obstetricians and Gynaecologists of Canada's *Clinical Practice Guideline No. 316 Parvovirus B19 in Pregnancy* (December 2014).

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MEASLES (RUBEOLA)

OVERVIEW

Please refer to provincial/territorial guidelines for Measles (Rubeola) where available.

Measles is one of the most highly-communicable and vaccine-preventable infectious diseases. Among susceptible individuals, measles has a greater than 90% secondary attack rate.⁽¹⁾

Consult with physician/nurse practitioner immediately when there is suspicion of Measles (Rubeola) as it is a public health emergency.

CAUSES

Measles virus⁽¹⁾

TRANSMISSION

- Transmitted primarily through the respiratory droplet route (through contact with nasal or throat secretions from infected individuals)
- Airborne transmission can also occur in closed settings
- The measles virus can survive at least 2 hours in evaporated droplets and in fine particle airborne spread.⁽¹⁾

INCUBATION PERIOD

The incubation period of measles, from exposure to prodrome, averages 10 to 12 days. The time from exposure to rash onset averages 7–21 days.⁽²⁾

COMMUNICABILITY

- Measles may be transmitted during the prodrome, and from approximately 4 days before and up to 4 days after appearance of the rash.⁽³⁾
- Immunocompromised persons with prolonged excretion of the virus in respiratory secretions can be contagious for the duration of their illness.⁽⁴⁾

ASSESSMENT

Medication review: Review current medications, over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Individuals who have not had measles or who have not been adequately immunized are at risk of infection.
- Individuals born in or after 1970 are considered susceptible unless there is serological proof of immunity or documented history of 2 doses of measles-containing vaccine.⁽⁴⁾
- Individuals at greatest risk of measles exposure include travellers to destinations outside the Americas, health care workers, and students.⁽¹⁾
- Groups at high-risk for measles complications include immunocompromised individuals, pregnant women and infants.⁽⁴⁾

Note: In Canada, adults born before 1970 are generally presumed to have acquired natural immunity to measles. This is due to high levels of measles circulation before that time.

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness:

- Prodromal fever⁽¹⁾
- Fever (often rises as the rash appears)⁽⁴⁾
- Classic triad of cough, coryza and conjunctivitis⁽¹⁾
- Rash, which generally appears 14 days after exposure or 2–4 days after prodrome and lasts 5–6 days

- Anorexia and diarrhea, especially in infants⁽²⁾
- Determine immunization history, including the number of doses, the date administered and the type of vaccine.⁽⁴⁾

Social

- Obtain a history of exposure to determine the possible source of infection.⁽⁴⁾
- Identify recent travel history during the incubation period (approximately 12 days).
- Identify recent contact with a confirmed or probable case of measles.

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Fever of 38.3 degrees Celsius or higher⁽³⁾
- Generalized erythematous, maculopapular rash:⁽¹⁾
 - Typically begins at the hairline, then moves to the face and neck, gradually spreading down the trunk and extremities to reach the hands and feet
 - Lesions are usually discrete, but may become confluent
 - Lesions blanch initially; however by days 3–4, most do not blanch with pressure
 - Fine desquamation may occur over more severely affected areas
 - The rash disappears in the same direction it appeared⁽²⁾
- Koplik spots, i.e., bluish-white spots with an erythematous base on buccal mucosa, occurs 1 to 2 days before the rash to 1 to 2 days after the rash
- Conjunctivitis
- Generalized lymphadenopathy⁽²⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Common viral respiratory viruses of childhood
- Rubella (German measles)
- Roseola infantum
- Cocksackievirus infection
- Infectious mononucleosis
- Scarlet fever
- Kawasaki disease
- Erythema infectiosum (for more information, see *FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 18 – Communicable Diseases – Common Communicable Diseases – Erythema Infectiosum (Fifth Disease)*).
- Adverse drug reaction⁽³⁾

COMPLICATIONS

- Otitis media
- Pneumonia
- Measles encephalitis and permanent brain damage
- Subacute sclerosing panencephalitis (extremely rare)⁽¹⁾
- Death^(1; 2)
- Measles infection during pregnancy results in a higher risk of premature labour, spontaneous abortion and low birth weight.⁽¹⁾

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

In order to maximize the sensitivity of testing from a suspected case of measles in the acute phase of illness, collect serum, nasopharyngeal swab, and urine samples.⁽⁴⁾ Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.

Recommended Samples

- Acute and convalescent Serum Immuno-globulin G (IgG) and Serum Immunoglobulin M (IgM):
 - Collect IgG at time of presentation and no later than 7 days from rash onset. Collect the convalescent sample 10-30 days after the initial sample.
Note: The paired sera are tested simultaneously to determine if seroconversion has occurred.
 - Collect serum IgM at time of presentation.
Note: Samples collected before 3 and after 28 days from the onset of symptoms may yield false negative results.
 - Collect nasopharyngeal swab for measles virus culture as soon as possible and no later than 4 days from the onset of rash.
 - Collect nasopharyngeal swab for measles ribonucleic acid (RNA) by RT-PCR within 7 days of rash onset, as specimens collected within this timeframe yield the best results.
 - Collect urine for measles virus culture within 7 days of rash onset to achieve maximum sensitivity.⁽⁴⁾

For interpretation of lab investigations, see *Table 1: Measles Testing Results* in *Appendix, Section A* of this guideline.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Provide supportive care
- Prevent disease transmission
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Interventions

For case and contact management, see *Appendix, Section A* of this guideline.

Client Education

No specific measles treatment is available; however, severe complications can be avoided through supportive care:

- Encourage activity as tolerated.
- Encourage good nutrition.
- Encourage adequate fluid intake to prevent dehydration.
- Provide information about disease transmission and appropriate infection control measures to minimize the possibility of transmission (including practicing good hand-washing hygiene, avoiding the sharing of drinking glasses or utensils and covering coughs and sneezes with a tissue or forearm).⁽⁴⁾
- Counsel client to return for further assessment if there is no improvement in the signs and symptoms of the presenting condition.
- Counsel parent(s)/caregiver/client about the appropriate use of medications; dose, frequency, importance of adherence, potential side effects and interactions.
- The client should not receive any acetylsalicylic acid (ASA) or products that contain ASA. Taking ASA increases the risk of getting Reye's syndrome, which can damage the liver and brain.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/ nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/ territorial formulary before initiating treatment.

Antipyretic/Analgesic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen⁽⁶⁾

- Acetaminophen 10 to 15 mg/kg/dose PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg/day, whichever is less.

Ibuprofen (7)**Infants <6 months**

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*)

*Maximum from all sources for all ages:

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours, whichever is less. Under physician/nurse practitioner supervision, daily doses $\leq 2,400$ mg may be used.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation and if unsure of the diagnosis.

MONITORING

If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

Advise parent(s)/caregiver(s) to bring the child back to the clinic if there are signs of complications.

Referral

- Arrange for medical evacuation if clinically indicated.
- Coordinate referral request(s) as required.

Reporting

- Measles is reportable. Notify the Public Health Physician of all confirmed, probable, and suspected cases of measles as soon as possible.⁽¹⁾
- Follow provincial/territorial policies and procedures for notifiable diseases. For more information, see *Appendix, Section B: Provincial/Territorial Guidelines for Measles (Rubeola)*.

APPENDIX**SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION****Prevention and Control⁽⁴⁾****Vaccination**

- Vaccination of susceptible individuals represents an important risk mitigation strategy.
- High vaccine coverage is needed to sustain measles elimination.
- In Canada, a 2-dose immunization schedule for measles is recommended for the routine immunization of children.
- Susceptible, immunocompetent individuals 12 months of age and older who are exposed to measles may be protected from measles disease if the Measles, Mumps, Rubella (MMR) vaccine is administered within 72 hours of exposure.
- The MMR vaccine may be recommended for children between 6-12 months of age for post-exposure management if given within 72 hours of exposure; however, 2 additional doses of measles-containing vaccine must be administered after the child is 12 months old (and at least 28 days from the previous dose) to ensure long-lasting immunity from measles.
- Women immunized against measles are advised not to become pregnant for at least 4 weeks after receiving the vaccine.

For more information, see the latest *Canadian Immunization Guide*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php>

Immunoglobulin (Ig)⁽⁴⁾

- Prophylactic use of Ig has been shown to be effective in modifying or preventing disease.
- Susceptible, exposed individuals who present more than 3 days (72 hours) after exposure (when MMR vaccine no longer provides post-exposure protection) but less than 6 days after exposure (when Ig may still provide post-exposure protection) can also be considered for Ig.
- Ig should be considered for susceptible contacts of measles, particularly immunocompromised individuals and pregnant women for whom measles-containing vaccine is contraindicated, as well as infants less than 6 months of age. Infants less than 6 months of age are usually considered immune due to antibodies transferred in utero from the mother; if, however, the mother contracts measles or is known to be non-immune, the infant should receive Ig.
- Consult with the Public Health Physician as per provincial/territorial policies and procedures to determine if initiation of Ig is required for the client, and make necessary arrangements for the client to receive Ig treatment.

Public Health Management⁽⁴⁾**Case Management**

Investigate all confirmed, probable, and suspected cases of measles as soon as possible according to provincial and territorial policies and procedures. Public health authorities should be notified of measles in accordance with provincial/territorial legislation for reporting communicable diseases.

- Exclude confirmed, probable, and suspected cases from daycare, school and employment, and keep cases away from non-household contacts, especially unimmunized children and pregnant women, for 4 days after the appearance of the rash.⁽⁴⁾

Contact Management

A contact is defined as any individual who has:

- Spent any length of time in a room or enclosed space with a confirmed measles case during that case's infectious period (i.e., approximately 4 days before rash onset to 4 days after rash onset); or
- Spent time in a room previously occupied by a measles case during that client's infectious period or within 2 hours after the case has left the room/space.
- Within 24 hours of reporting a suspect case of measles, all contacts should be identified and classified as susceptible or non-susceptible. The immunization status of community case contacts should be ascertained to determine susceptibility to measles. Public Health Authorities should determine the extent of contact tracing to be completed during an outbreak, based on the outbreak context and the resources available.
- Susceptible contacts who refuse or who cannot receive MMR vaccine or immune globulin maybe excluded from childcare facilities, schools and post-secondary educational institutions at the discretion of the Medical Officer of Health (MOH) from 5 days after first exposure and up to 21 days after last exposure.⁽⁴⁾

Interpretation of Lab Investigations

TABLE 1
Measles Testing Results⁽⁵⁾

TEST RESULT	INTERPRETATION
Reactive IgM antibody	<ul style="list-style-type: none"> - Possible acute measles infection - False positive may occur in about 0.4% of suspected cases - IgM is also detected after immunization against measles - IgM may remain detectable in some individuals for years after vaccination or natural infection
Non-reactive or equivocal IgM antibody	Not acute measles infection (Note: 20% of measles cases will not have a reactive IgM when blood is drawn within the first 3 days of rash)
Protective anti-measles IgG (generally greater than/equal to 200 mIU per millilitre)	Test results will be reported out as “reactive” (i.e., immune to measles)
A significant (4-fold) rise in IgG titre between the acute and convalescent sera	Acute measles infection
Positive culture or RT-PCR (nasopharyngeal swab, urine specimen)	Confirms acute measles infection

SECTION B: SUPPLEMENTAL RESOURCES

Provincial/Territorial Resources

Alberta

Alberta Health and Wellness
Public Health Notifiable Disease Guidelines:
Measles. Available from: <http://www.health.alberta.ca/professionals/notifiable-diseases-guide.html>

British Columbia

BC Centre for Disease Control
Communicable Disease Control Management
of Specific Diseases: Measles. Available from:
<http://www.bccdc.ca/health-info/diseases-conditions/measles>

Manitoba

Public Health and Primary Health Care
Communicable Disease Management Protocols:
Measles. Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/index.html>

Northwest Territories

Northwest Territories Health and Social Services
Communicable Disease Manual. Available from:
<http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Nova Scotia

Nova Scotia Department of Health and Wellness
Communicable Disease Manual: Measles.
Available from: <http://www.novascotia.ca/dhw/cdpc/cdc/>

Newfoundland and Labrador

Government of Newfoundland and Labrador
Health and Community Services
Newfoundland and Labrador Disease Control
Manual: Section 4, Diseases Preventable by
Routine Vaccination. Available from: http://www.health.gov.nl.ca/health/publications/diseasecontrol/s4_diseases_preventable_by_routine_vaccination.pdf

Yukon

Yukon Health and Social Services
Communicable Disease Control: Measles.
Available from: http://www.hss.gov.yk.ca/disease_guidelines.php

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MUMPS (PAROTITIS)

OVERVIEW

Please refer to provincial/territorial guidelines for Mumps (Parotitis) where available.

Mumps is a highly-contagious, acute viral infection characterized by painful swelling of one or more of the salivary glands (most commonly the parotid glands).⁽²⁾ Diagnosis can be difficult due to the non-specific and/or primarily respiratory symptoms that occur in about 50% of those who acquire mumps infection.⁽¹⁾ Systemic symptoms usually resolve within 3 to 5 days, and parotid swelling subsides within 7 to 10 days.⁽²⁾ Mumps is a vaccine-preventable disease.

Consult with physician/nurse practitioner immediately when there is suspicion of mumps as it may require urgent medical evacuation.

CAUSES

Mumps virus⁽²⁾

TRANSMISSION

- Direct contact with saliva⁽²⁾
- Respiratory droplets⁽²⁾
- Contact with contaminated fomites⁽²⁾

INCUBATION PERIOD

12 to 25 days⁽²⁾

COMMUNICABILITY

- The infectious period occurs between 7 days before and 5 days following the onset of symptoms.⁽¹⁾
- In approximately 20-30% of mumps cases, infections are subclinical, but remain communicable.⁽¹⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- In general, individuals of all ages who have not had mumps or who have not been immunized according to the recommended immunization schedule are at risk of being infected.
- Individuals born before 1970 are presumed to have acquired natural immunity to mumps.
- Adolescents and adults born in or after 1970 and who are at the greatest risk of exposure to mumps include:⁽²⁾
 - Students in secondary and post-secondary educational settings
 - Travellers to destinations outside North America
 - Individuals exposed to a mumps outbreak
 - Health care workers
 - Military personnel

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

- Unilateral or bilateral pain and swelling of parotid or other salivary glands⁽³⁾
- Earache or pain at the angle of the jaw⁽³⁾
- Immunization history, including dates and number of doses of mumps-containing vaccine received⁽³⁾

- Non-specific prodromal symptoms may precede parotitis by several days, and may include:⁽³⁾
 - Low-grade fever (which may last 3 to 4 days)
 - Malaise
 - Anorexia
 - Headache
 - Myalgia

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Swelling of parotid glands (unilateral or bilateral) which may be very tender to the touch⁽³⁾
 - Other salivary glands may also be swollen⁽³⁾
- Testicular swelling and tenderness (orchitis)⁽³⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Parainfluenza virus types 1 and 3⁽⁴⁾
- Epstein Barr virus⁽⁴⁾
- Influenza A virus⁽⁴⁾
- Coxsackie A virus⁽⁴⁾
- Echovirus⁽⁴⁾
- Human immunodeficiency virus⁽⁴⁾
- Non-infectious causes, including:⁽⁴⁾
 - Medications (thiazide diuretics)
 - Tumors
 - Immunologic diseases (e.g., Sjögren's syndrome causing parotitis, keratoconjunctivitis, absence of tears)
 - Salivary duct obstruction

COMPLICATIONS

- Orchitis⁽²⁾
- Oophoritis⁽²⁾
- Viral meningitis⁽²⁾
- Pancreatitis⁽⁵⁾
- Hearing loss^(3; 5)

- Encephalitis (rare)⁽³⁾
- Arthritis⁽²⁾
- Thyroiditis⁽²⁾

Note: Infection occurring in unimmunized adults is more likely to result in complications.⁽²⁾ Mumps infection during the first trimester of pregnancy has been associated with spontaneous abortion.⁽²⁾

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.

Diagnostic work-up of clinical and suspect cases may include both serology and virus detection (by PCR testing and/or isolation in cell culture).

- Buccal swab for virus detection (ideally PCR) within the first 3 to 5 days of parotitis or symptom onset⁽⁶⁾
- The preferred specimen is buccal swab or saliva from the buccal cavity⁽⁶⁾

If client presents within 5 days of symptom onset

- Serology for acute and convalescent IgG and IgM antibodies. The acute serum sample should be collected as soon as possible upon suspicion of mumps and within 5 days after symptom onset.⁽⁶⁾
- The convalescent serum should ideally be collected at least 10 days and up to 3 weeks after the first sample⁽⁶⁾

If client presents more than 5 days after symptom onset

- Urine for PCR or mumps virus culture (the virus can be isolated from the urine for up to 2 weeks in those who have not been immunized previously)⁽³⁾

For interpretation of lab results, see *Table 1: Parotitis Test Results* in *Appendix, Section A* of this guideline.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Prevent complications
- Prevent disease transmission

NON-PHARMACOLOGICAL INTERVENTIONS**Client Education**

- There is no specific treatment for mumps. All confirmed and clinical cases of mumps should be offered supportive care,⁽⁴⁾ including:
 - Activity as tolerated
 - Fluids in amounts adequate to prevent dehydration
 - Warm or cold compresses applied to the parotid area may be helpful⁽⁷⁾
 - Local application of cold compresses and gentle support for the scrotum (may minimize testicular pain)⁽⁷⁾
- Advise client and/or parent(s)/caregiver(s) to limit visitors, especially unimmunized children and pregnant women, for 5 days after parotid swelling starts.
- Advise client to stay home from school or post-secondary educational institutions, child care facilities, workplaces, and other group settings for 5 days from symptom onset.⁽⁸⁾

- Encourage client to practice good hand hygiene, avoid sharing drinking glasses or utensils, and to cover coughs and sneezes with a tissue or forearm.⁽⁸⁾
- Counsel client and parent(s)/caregiver(s) about appropriate use of medications: dose, frequency, importance or adherence, potential side effects and interactions.
- The client should not receive any acetylsalicylic acid (ASA) or products that contain ASA. Taking ASA increases the risk of getting Reye's syndrome, which can damage the liver and brain.
- Counsel client to return for further assessment if no improvement in signs and symptoms of presenting condition.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/ nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/ territorial formulary, and the drug-specific reminders included in the Clinical Care Protocol before initiating treatment.

Analgesic/Antipyretic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen⁽⁹⁾

- Acetaminophen 10 to 15 mg/kg/dose PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg/day, whichever is less.

Ibuprofen⁽¹⁰⁾**Infants <6 months**

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*

***Maximum from all sources for all ages:**

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours whichever is less. Under physician/nurse practitioner supervision, daily doses $\leq 2,400$ mg may be used.

- Consider follow-up at about 1 week after onset of parotitis to determine whether symptoms have resolved (or are resolving) and to address any vaccination gaps.⁽¹¹⁾
 - Complete recovery usually occurs in 1 to 2 weeks.

Referral

- Arrange for medical evacuation if clinically indicated.
- Coordinate referral request(s) as required.

Reporting

Mumps is a reportable disease. Follow provincial/territorial policies and procedures for notifiable diseases.⁽⁸⁾

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

- Advise parents(s)/caregiver(s) to bring the child back to the clinic if there are signs of complications requiring immediate follow-up (e.g., pancreatitis, meningitis, encephalitis).

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

TABLE 1

Parotitis Test Results⁽⁶⁾

TEST RESULT	INTERPRETATION
Positive PCR (oral swab or urine), regardless of serology result	Mumps
Reactive IgM antibody	<ul style="list-style-type: none"> - Possible acute mumps infection <p>Note: without additional confirmatory testing (i.e., IgG seroconversion or virus identification), this may be a false positive IgM result. Such cases should be reported as clinical/probable unless epidemiologically-linked to a laboratory-confirmed case or outbreak-related.</p>
Non-reactive or equivocal IgM antibody	<p>In an unvaccinated person</p> <ul style="list-style-type: none"> - Not acute mumps infection (unless blood was drawn too early) <p>In a previously vaccinated person</p> <ul style="list-style-type: none"> - Possible acute mumps infection (viral identification is required for confirmation in previously-vaccinated people with this serological result)
Reactive IgG antibody	<ul style="list-style-type: none"> - Immunity to mumps
Non-reactive or equivocal IgG antibody	<ul style="list-style-type: none"> - Not immune to mumps

Contact Management

- The public health response to increased mumps activity includes:⁽⁸⁾
 - Managing cases
 - Contact identification and management
 - Identifying social networks
 - Maintaining/enhancing surveillance for further cases and disease outcomes (e.g., hospitalizations, complications)
- Generally, a mumps outbreak is controlled using the following methods:⁽⁸⁾
 - Defining at-risk population(s) and transmission settings
 - Preventing further transmission through case isolation and contact education/awareness
 - Protecting susceptible populations with immunization where no contraindication to measles-mumps-rubella (MMR) vaccine exists
- Contacts are defined by fulfillment of at least one of the following criteria during the infectious period (i.e., approximately 7 days before to 5 days after symptom onset):⁽¹⁾
 - Household members and close contacts of a case
 - Persons who share sleeping arrangements with the client, including sharing a room
 - Direct contact with the oral/nasal secretions of a case, sharing cigarettes/drinking glasses/food/cosmetics such as lip gloss, kissing on the mouth

- Children and staff in child care and school facilities (as deemed necessary by the epidemiology of the outbreak)
- Health care workers with unprotected face-to-face interaction within 1 metre of an infectious mumps case
- Susceptible contacts include:
 - Those born in Canada in 1970 or later who did not receive 2 doses of mumps-containing vaccine (at least 4 weeks apart) on or after their first birthday
 - Those without past history of laboratory confirmed mumps
 - Those without documented immunity to mumps

Assessment of immunization status and immunization with a mumps-containing vaccine as appropriate for age and risk factors should be conducted for susceptible contacts. Although mumps immunization after exposure to mumps may not prevent the disease, should the exposure not result in infection, the vaccine will confer protection against future exposures.⁽¹⁾

Note: Post-exposure prophylaxis with mumps immune globulin (Ig) is ineffective.⁽⁸⁾

- Contacts should be advised:
 - On the signs and symptoms of mumps infection (which can occur within 25 days of exposure)
 - To seek medical attention upon symptom onset if required
 - To inform the local public health unit as per provincial/territorial policies and procedures⁽⁸⁾
- Isolation of mumps-susceptible contacts is not required. On the basis of the epidemiology of the outbreak, susceptible groups should be targeted for immunization, especially those at greatest risk of exposure.⁽⁸⁾
- The dissemination of information to contacts should include:
 - Information on mumps disease
 - Its symptoms and prevention
 - Advice to visit one's health care provider should any symptoms develop

Prevention

In Canada, the administration of a mumps-containing vaccine is part of the routine 2-dose childhood immunization schedule. The first dose of mumps-containing vaccine is given at 12 to 15 months of age, and the second dose at 18 months of age or any time thereafter. It should be given no later than around the time of school entry.⁽¹²⁾ The National Advisory Committee on Immunization publishes detailed recommendations pertaining to the use of vaccines in Canada and are available from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-14-mumps-vaccine.html>

SECTION B: SUPPLEMENTAL RESOURCES

Provincial/Territorial Guidelines

Alberta

Alberta Health and Wellness
Notifiable Disease Guidelines: Mumps.
Available from: <https://open.alberta.ca/publications/mumps>

British Columbia

BC Centre for Disease Control Communicable Disease Control Manual Mumps. Available from: <http://www.bccdc.ca/health-professionals/clinical-resources/communicable-disease-control-manual/communicable-disease-control>

Manitoba

Public Health and Primary Health Care
Communicable Disease Management Protocols: Mumps. Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/mumps.pdf>

Newfoundland and Labrador

Department of Health and Community Services
Newfoundland and Labrador Disease Control Manual: Section 4, Diseases Preventable by Routine Vaccination. Available from: http://www.health.gov.nl.ca/health/publications/diseasecontrol/s4_diseases_preventable_by_routine_vaccination.pdf by clicking *Mumps* in the table of contents.

Northwest Territories

Northwest Territories Health and Social Services Communicable Disease Manual. Available from: <http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Nova Scotia

Nova Scotia Department of Health and Wellness Nova Scotia Communicable Disease Manual: Mumps. Available from: <https://novascotia.ca/dhw/cdpc/cdc/documents/Mumps.pdf>

Ontario

Ontario Ministry of Health and Long-Term Care Infectious Diseases Protocol. Appendix A: Disease-Specific Chapters: Mumps. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/mumps_chapter.pdf

Ontario Ministry of Health and Long-Term Care Mumps Fact Sheet. Available from: http://www.health.gov.on.ca/en/pro/programs/immunization/docs/hcp_fact_sheets_mumps.pdf

Yukon

Yukon Health and Social Services Yukon Communicable Disease Control: Mumps. Available from: http://www.hss.gov.yk.ca/pdf/ycdc_mumps.pdf

Other Resources

Public Health Agency of Canada. National Advisory Committee on Immunization. Statement on Measles-Mumps-Rubella-Varicella Vaccine. [Internet] Ottawa, ON: Public Health Agency of Canada; 2010 September. Available from: <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/10vol36/acs-9/index-eng.php>

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PERTUSSIS (WHOOPIING COUGH)

OVERVIEW

Please refer to provincial/territorial guidelines for Pertussis where available.

Pertussis (whooping cough) is a highly-contagious, acute bacterial illness of the upper respiratory tract.⁽¹⁾ Although the incidence of pertussis in Canada has decreased by over 90% since the introduction of the pertussis vaccine in 1943, it continues to be the most common of all diseases preventable by routine childhood immunization.⁽¹⁾

Consult with physician/nurse practitioner immediately when there is suspicion of pertussis in infants as it may require urgent medical evacuation.

CAUSES

Bordetella pertussis (*B. pertussis*) bacteria⁽¹⁾

TRANSMISSION

- Aerosolized droplets of respiratory secretions⁽¹⁾
- Direct contact with respiratory secretions from the infected person⁽²⁾

INCUBATION PERIOD

9 to 10 days (range is 6 to 20 days) and rarely as long as 42 days⁽³⁾

COMMUNICABILITY

- Highly transmissible in the early catarrhal stage and in the first 2 weeks after cough onset.⁽³⁾
- Communicability is negligible 3 weeks after coughing onset.⁽³⁾
- Infected individuals are not usually contagious after 5 days of appropriate antibiotic therapy.⁽³⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Young age and/or incomplete or waned immunity:
 - Severe pertussis-related morbidity and high mortality rates occur almost entirely in infants who are too young to be protected by a complete vaccine series.⁽³⁾
 - Adolescents and adults who have not received a booster vaccination are at risk of infection and may transmit the bacteria to others, as immunity to pertussis from childhood vaccination and natural disease wanes with time.⁽³⁾ Immunity wanes 5-10 years after last pertussis vaccine dose.^(2; 3)
- Pregnant women with pertussis near term and other household contacts with pertussis are an important source of pertussis for newborn infants.⁽²⁾
- For more information on vaccination series, see *Appendix, Section A* of this guideline.

HISTORY OF PRESENT ILLNESS

- Review risk factors and collect history of present illness.
- Obtain the immunization history.
- A child presenting with paroxysmal cough, post-tussive vomiting, and whoop is likely to have an infection caused by *B. pertussis*.⁽⁴⁾

- Pertussis should be suspected when any client has:
 - A cough that does not improve within 14 days
 - A paroxysmal cough of any duration
 - A cough followed by vomiting or
 - Any respiratory symptoms after contact with a laboratory-confirmed case of pertussis⁽⁴⁾

Illness stages

The course of illness is typically divided into 3 stages:

Catarrhal Stage (First Stage)

- Characterized by the insidious onset of coryza, sneezing, low-grade fever, malaise, conjunctival redness, lacrimation and mild occasional cough⁽¹⁾
- The catarrhal stage lasts 1 to 2 weeks⁽¹⁾

Paroxysmal Stage (Second Stage)

- Most complications occur during this stage; fever is uncommon and suggests bacterial superinfection⁽⁴⁾
- Characterized by paroxysmal cough, increasing in frequency and severity, with a high-pitched inspiratory whoop at end of paroxysm. The frequency of paroxysmal episodes varies widely, from several per hour to 5 to 10 per day. Episodes are often worse at night and interfere with sleep⁽⁴⁾
- Between attacks, the client's appearance is normal, but increasing fatigue is evident.⁽⁴⁾
- The paroxysmal stage can last from 2 to 8 weeks⁽³⁾

Note: the classic paroxysmal stage presentation is most often seen in preschool and children of school age⁽⁴⁾

Convalescent Stage (Third Stage)

Symptoms gradually wane over weeks to months.⁽¹⁾

Social History

- Contact history to identify possible source and to identify susceptible contacts, including contacts at high risk for severe disease
- School, daycare attendance

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Low-grade fever during catarrhal stage⁽⁴⁾
- Rhinorrhea/coryza⁽⁴⁾
- Paroxysmal cough, often within a single expiration, and audible whoop at end of coughing paroxysm⁽⁴⁾
- Apnea and cyanosis in infants⁽⁵⁾
- Signs of dehydration (may be present)⁽¹⁾

Note: In young infants (who are at the highest risk of severe disease and complications), clinical symptoms are frequently atypical. Whoop and post-tussive vomiting may be absent, and the presentation may be characterized solely by episodes of cyanosis and apnea.⁽⁴⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- *Mycoplasma pneumoniae*⁽⁵⁾
- *Chlamydophila pneumoniae*⁽⁵⁾
- Tuberculosis⁽⁵⁾
- Viral pathogens, including:⁽⁵⁾
 - Respiratory syncytial virus (RSV)
 - Adenovirus
 - Parainfluenza viruses
 - Influenza A and B viruses
 - Rhinovirus
 - Human metapneumovirus
- Noninfectious processes, including:⁽⁵⁾
 - Foreign body aspiration
 - Reactive airway disease/asthma
 - Allergic or infectious sinusitis
 - Gastroesophageal reflux
 - Aspiration pneumonia

COMPLICATIONS

- Bacterial pneumonia (most common complication and cause of death in infants)⁽³⁾
- Neurological complications such as seizures (febrile and afebrile) and encephalopathy⁽³⁾
- Otitis media⁽¹⁾

- Anorexia⁽¹⁾
- Weight loss and dehydration⁽⁴⁾
- Apnea⁽¹⁾
- Death⁽¹⁾

Complications from intense and persistent coughing in adolescents and adults include:⁽³⁾

- Sleep disturbance
- Rib fractures
- Subconjunctival hemorrhages
- Rectal prolapse
- Urinary incontinence

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures and guided by client's clinical presentation.

- Nasopharyngeal swab for culture and/or PCR for *B. pertussis* using Calgi (calcium alginate) or Dacron swabs. Cotton swabs should not be used for culture of nasopharyngeal specimens for *B. pertussis* because cotton inhibits the growth of the organism.⁽⁶⁾
- A properly-obtained nasopharyngeal swab is essential for optimal results.⁽⁷⁾ For an illustration demonstrating proper collection technique, see *Appendix, Section A* of this guideline.
- Instructional videos for collection of nasopharyngeal specimens are also available from: <https://www.cdc.gov/pertussis/clinical/diagnostic-testing/specimen-collection.html>
- CBC⁽⁶⁾

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Cure infection, when possible
- Relieve symptoms
- Prevent disease transmission
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Client Education

Provide the following education/counselling to the parent(s)/caregiver(s) and/or client:

- Activity as tolerated
- Encourage adequate fluid intake to maintain hydration
- Keep the home free from irritants that can trigger coughing, such as smoke, dust, and chemical fumes⁽⁸⁾
- Limit new visitors to the home until 5 days after antibiotic therapy has started.
- Isolate a client with confirmed or suspected pertussis from young children and infants until the client has received at least 5 days of antibiotics⁽³⁾
- Isolate a client with suspected pertussis who does not receive antibiotics for 21 days after cough onset,⁽⁹⁾
- Counsel parent(s)/caregiver(s) and/or client on appropriate use of medications; including dose, frequency, importance of adherence, potential side effects and interactions.

For more information on caring for children with pertussis, see the *Caring for Kids' Pertussis (Whooping Cough)* handout, available from: http://www.caringforkids.cps.ca/handouts/pertussis_whooping_cough.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/ nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/ territorial formulary before initiating treatment.

Note: Pharmacological therapy to manage pertussis-related cough (e.g., bronchodilators, antitussives, corticosteroids) are not indicated; medications to manage pertussis-related cough are not effective, and there may be more risks associated with side effects from these medications than benefits.⁽¹⁰⁾

IV Therapy

IV fluid (such as 0.9% sodium chloride) may be required for client who is unable to tolerate oral feedings or who presents with signs of dehydration (e.g., due to vomiting).^(10; 11) For more information on pediatric fluid requirements, see *FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 4 – Fluid Management – Fluid Requirements in Children*.

Antipyretic/Analgesic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen⁽¹²⁾

- Acetaminophen 10 to 15 mg/kg PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg/day, whichever is less.

Ibuprofen⁽¹⁵⁾

Infants <6 months

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*

*Maximum from all sources for all ages:

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours whichever is less. Under physician/nurse practitioner supervision, daily doses $\leq 2,400$ mg may be used.

Antimicrobial Therapy

- Antimicrobial treatment administered in the catarrhal phase of the illness can decrease the duration and severity of symptoms.⁽²⁾
- Preferred treatment for pertussis is with macrolides (i.e., azithromycin, erythromycin, clarithromycin)⁽¹⁶⁾
- A shorter course (i.e., 3 days) of azithromycin for treatment or postexposure prophylaxis of *B. pertussis* has not been validated and is not recommended.⁽¹⁷⁾
- Azithromycin is the first choice because it is given in a short and simple regimen.⁽⁷⁾ It is the drug of choice for infants less than 1 month of age.⁽¹³⁾

Preferred Treatment⁽⁹⁾

Azithromycin

Infants less than 6 months of age

- Azithromycin PO daily for 5 days (calculate 10 mg/kg in 24 hours)

Infants and children 6 months of age or greater

Day 1

- Azithromycin PO once daily
- (calculate 10 mg/kg in 24 hours; maximum 500 mg/in 24 hours for one dose on day 1)

Days 2-5

- Azithromycin PO once daily on days 2 to 5
- (calculate 5 mg/kg/day; maximum 250 mg in 24 hours)

Alternate Treatment for Client with Contraindication to Azithromycin

Trimethoprim-sulfamethoxazole (co-trimoxazole) (TMP-SMX) can be used as an alternative agent to macrolides in patients aged ≥ 2 months who are allergic to macrolides, who cannot tolerate macrolides, or who are infected with a rare macrolide-resistant strain of *Bordetella pertussis*.

Trimethoprim-sulfamethoxazole**Infants aged < 1 months**

- Contraindicated because of risk for kernicterus

Infants from 1 to 5 months

- Trimethoprim-sulfamethoxazole PO, TMP 8 mg/kg and SMX 40 mg /kg in two divided doses for 14 days

Infants and children greater than six months of age

- Trimethoprim-sulfamethoxazole PO, TMP 8 mg/kg and SMX 40 mg /kg in two divided doses for 14 days (maximum TMP 320 mg, SMX 1600 mg per day)

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.
- Monitor vital signs as indicated by client's condition.

FOLLOW-UP

- Follow up every few days to every 2 weeks as necessary, to reassess client status and monitor for complications.
- Advise the parent(s)/caregiver(s) and/or client that the client should immediately return for follow-up if complications arise.

Referral

- Arrange for medical evacuation if clinically indicated (e.g., infants and older children with severe disease manifestations or complications).

Reporting

Pertussis is a reportable disease. Follow provincial/territorial policies and procedures for reportable diseases.

APPENDIX**SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION****Contact Management**

Contacts, especially children, must have their immunization status verified. If immunization status is incomplete and no contraindications are identified, recommended doses of vaccine should be given.

Pertussis Vaccination in Pregnancy

- The National Advisory Committee on Immunization (NACI) currently does not recommend a universal program for vaccination of pregnant women.
- In special circumstances, such as a regional outbreak situation, immunization with Tdap (an acellular pertussis-containing formulation) may be offered to pregnant women (≥ 26 weeks of gestation) irrespective of their immunization history.
- For information on pertussis vaccination in pregnancy, see the Public Health Agency of Canada's *Update on Pertussis Vaccination in Pregnancy*, available from: http://www.phac-aspc.gc.ca/naci-ccni/acs-dcc/2014/pvip-vcpg_0214-eng.php

Prevention⁽³⁾

- Pertussis can be prevented by immunization. Educate the public about the dangers of pertussis and the advantages of initiating immunization at 2 months of age and adhering to the immunization schedule.⁽¹⁴⁾
- For adults, 1 dose of acellular pertussis-containing vaccine (Tdap) should be administered if the person has not previously received it in adulthood (18 years of age and older).
- Adults of any age, who have not received a dose of Tdap vaccine in adulthood and who are in contact or anticipate contact with infants (e.g., parents, grandparents, child-care providers), should receive pertussis vaccination.
- For comprehensive information about immunization recommendations, please refer to the most recent version of the *Canadian Immunization Guide*, available from <https://www.canada.ca/en/public-health/services/canadian-immunization-guide.html>

Epidemiology of Pertussis in Canada

For information on the epidemiology of pertussis in Canada, see the *Canadian Communicable Diseases Report*, available from: <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/>

Nasopharyngeal Swab Collection Technique

For information on the collection of nasopharyngeal specimens, see Cadham Provincial Laboratory's *Collection of Nasal Specimens*, available from: http://www.gov.mb.ca/health/publichealth/cpl/docs/nasopharyngeal_collection.pdf.

SECTION B: SUPPLEMENTAL RESOURCES**Provincial/Territorial Guidelines****Alberta**

Alberta Health and Wellness
Public Health Notifiable Disease Guidelines: Pertussis. Available from: <https://open.alberta.ca/publications/pertussis>

British Columbia

BC Centre for Disease Control Communicable Disease Control Management of Specific Diseases: Pertussis. Available from: <http://www.bccdc.ca/health-professionals/clinical-resources/communicable-disease-control-manual/communicable-disease-control>

Manitoba

Public Health and Primary Health Care
Communicable Disease Management Protocols: Pertussis. Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/pertussis.pdf>

Newfoundland and Labrador

Community Services
Newfoundland and Labrador Communicable Disease Control Manual: Section 4, Diseases Preventable by Routine Vaccination. Available from: <http://www.health.gov.nl.ca/health/publichealth/cdc/control.html> by clicking Pertussis (Whooping Cough) in the table of contents.

Northwest Territories

Health and Social Services
Communicable Disease Manual. Available from: <http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Nova Scotia

Health and Wellness
Nova Scotia Communicable Disease Manual: Pertussis. Available from: <https://novascotia.ca/dhw/cdpc/cdc/documents/pertussis.pdf>

Ontario

Ontario Ministry of Health and Long-Term Care
Diseases and Conditions: Pertussis. Available from: <http://www.health.gov.on.ca/en/pro/publications/disease/>

Yukon

Yukon Health and Social Services
Yukon Communicable Disease Control: Pertussis. Available from: http://www.hss.gov.yk.ca/pdf/ycdc_pertussis.pdf

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PINWORMS

OVERVIEW

Please refer to provincial/territorial guidelines for Pinworms where available.

Pinworm infection (Enterobiasis) is a common parasitic infection.⁽¹⁾ It occurs worldwide and commonly clusters within families. Prevalence rates are higher among the following populations: pre-school and school-aged children, primary caregivers of infected children and institutionalized individuals.⁽²⁾

CAUSES

Enterobius vermicularis (*E. vermicularis*)⁽³⁾

TRANSMISSION

- Infection begins when the embryonic eggs are ingested or inhaled and swallowed.⁽⁴⁾
- Eggs hatch in the upper intestine and then mature and migrate through the intestine.⁽⁴⁾
- Adult gravid female pinworms migrate nocturnally outside the anus and deposit eggs while crawling on the perianal area and perineal skin.⁽³⁾
- The movement of the worms on skin and mucous membranes causes intense itching.⁽⁴⁾ As the child scratches, eggs are deposited on the hands and underneath the fingernails.⁽⁴⁾ The typical hand-to-mouth activity of young children makes them especially prone to reinfection.⁽⁴⁾
- Other modes of transmission involve exposure to objects contaminated with pinworm eggs (e.g., curtains, carpeting, bed linens, clothing, toilet seats, doorknobs and food).^(3; 4)

INCUBATION PERIOD

- The interval between ingestion of the egg, migration of the gravid adult female to the perianal region and deposit of eggs is 1 to 2 months or longer.⁽²⁾

COMMUNICABILITY

- Pinworm eggs remain infective in an indoor environment for 2 to 3 weeks.⁽²⁾
- A person remains infectious as long as female nematodes are discharging eggs on perianal skin.⁽²⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Pre-school and school aged children⁽³⁾
- Close contacts of people with enterobiasis (e.g., household members)⁽³⁾
- Crowded conditions (e.g., classrooms, daycare centres, institutions)⁽³⁾

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

- Many individuals with pinworm infection are asymptomatic⁽⁵⁾
- Intense perianal itching, especially at night⁽⁵⁾
- Difficulty sleeping due to pruritus⁽⁵⁾
- Other complaints may include anorexia, irritability and abdominal pain⁽³⁾

Social History

- It is important to obtain a history of family living conditions because tape test confirmation of pinworm presence is not necessarily the determining factor in deciding to treat the client. Other factors that influence the decision would be co-sleeping, lack of washing facilities and the availability of hot water.

PHYSICAL FINDINGS

If pinworm infestation is suspected, perform a physical examination using the IPPA approach; any or none of the following may be evident:

- Perianal and/or perineal area excoriation⁽²⁾
- Secondary bacterial infection due to scratching⁽²⁾
- Small white worms visible in the perianal area⁽²⁾

Tape test may be required for some clients. For more information on how to perform a tape test, see *Appendix, Section A* of this guideline.

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Hemorrhoids
- Tapeworm⁽⁷⁾

COMPLICATIONS

- Appendicitis⁽²⁾
- Pelvic peritonitis⁽²⁾
- Urethritis⁽²⁾
- Eosinophilic colitis^(8; 9)
- Granulomatous reactions in the gastrointestinal or genitourinary tracts⁽⁹⁾
- Salpingitis⁽²⁾
- Vulvovaginitis^(2; 3)

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.

- Examination of stool specimens for ova and parasites is not recommended (egg shedding does not occur inside the intestinal lumen;⁽¹⁾ therefore, very few ova are present in stool).
- Examine the perianal and perineal area 2 to 3 hours after the client is asleep⁽¹⁾ (that is the time adult female pinworms are most likely to be seen in the region).
- If the adult female pinworms have not been seen, the parent(s)/caregiver(s)/client should perform the tape test at home (it may be necessary to repeat the test on three separate mornings to obtain eggs).⁽¹⁾ For more information on how to perform the tape test, see *Appendix, Section A* of this guideline.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Relieve infestation
- Prevent transmission to others
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Client Education

- Instruct parent(s)/caregiver(s)/client on the importance of establishing the following behaviours among family members and close contacts:
 - Wash hands carefully after going to the toilet, changing diapers and before preparing or eating food.⁽⁶⁾
 - Keep everyone's fingernails short and avoid nail-biting.⁽⁶⁾
 - Avoid or prevent scratching of perianal and perineal areas.⁽⁶⁾
 - Take a bath in the morning to get rid of many of the eggs.⁽⁶⁾
 - Clean the home, change and wash bed linens and clothing frequently. This will destroy eggs and help prevent reinfection. Avoid shaking bed linens and clothing because this can scatter the eggs.⁽⁶⁾
 - Open blinds or curtains in bedrooms during the day⁽⁶⁾ as eggs die when exposed to sunlight.
- Re-infections with pinworms can occur if the client comes into contact with pinworm eggs again.
- Pinworms can stay alive in the home for up to 3 weeks.⁽⁶⁾
- Counsel parent(s)/caregiver(s)/client about appropriate use of medications; dose, frequency, importance of adherence, potential side effects and interactions.⁽⁶⁾

For more information on caring for a child with pinworms, see the Caring for Kids' *Pinworms* handout, available from: <http://www.caringforkids.cps.ca/handouts/pinworms>

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary before initiating treatment.

Pyrantel Pamoate^(5; 10)

- Pyrantel pamoate dosing is weight-based at 11 mg/kg PO as a single dose (maximum dose 1,000 mg) and the treatment has to be repeated in two weeks.
- The tablets are supplied as 125 mg and as such, achieving an exact weight-based dose is not likely.

Note: Consult with physician/nurse practitioner for children less than 1 year of age. The risks and benefits should be considered before initiation of treatment.

Dosing recommendations for children who are 1 year of age and older:

Pyrantel pamoate

Children less than 12 kg

- Pyrantel pamoate 125 mg PO for 1 dose

Children 12 to 23 kg

- Pyrantel pamoate 250 mg PO for 1 dose

Children 24 to 45 kg

- Pyrantel pamoate 500 mg PO for 1 dose

Children 46 to 68 kg

- Pyrantel pamoate 750 mg PO for 1 dose

Children greater than or equal to 69 kg

- Pyrantel pamoate 1,000 mg PO for 1 dose

Note: a single dose results in relatively high cure rates, although a second dose repeated at two weeks achieves a cure rate close to 100 percent and helps prevent recurrence due to reinfection.

Reinfection is common, despite effective therapy. Therefore, simultaneous treatment of the entire household is warranted given high transmission rates among families.⁽⁵⁾ In addition, all bedding and clothes should be washed. Hygienic measures, such as clipping of fingernails, frequent handwashing, and baths, are also helpful for reducing reinfection.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

- Advise follow-up in 2 weeks as re-infection may occur and a second dose may be required to eradicate pinworm infection.
- Counsel parent(s)/caregiver(s)/client that client is to return for further assessment if there is no improvement in signs and symptoms of presenting condition following treatment.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Tape Test⁽¹⁾

- Inform parent(s)/caregiver(s)/client that the test should be performed when the client awakens in the morning (before bathing or having a bowel movement).
- Teach parent(s)/caregiver(s)/client how to perform the tape test:⁽¹⁾
 1. Collect the eggs by pressing transparent (not translucent) adhesive tape around the perianal area and perineal skin several times (the procedure may need to be repeated for 3 or more consecutive days before eggs are collected).

2. Place the transparent tape in a glass jar or loosely in a plastic bag and bring it to the clinic for microscopic examination.

Diagnosis

- Diagnosis is done using the tape test.
- Diagnosis is positive when pinworm eggs are seen on the tape.
 - When this occurs, the parent(s)/caregiver(s)/client may be required to bring the sample to the clinic.
- The nurse will apply the tape to a glass slide and examine it under a low-power microscopic lens, if available.

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ROSEOLA INFANTUM

OVERVIEW

Please refer to provincial/territorial guidelines for Roseola Infantum where available.

Roseola infantum ('roseola' or 'sixth disease') is usually a benign, self-limited viral illness.⁽²⁾ It is characterized by the sudden onset of high fever lasting several days and is typically followed by the sudden appearance of a diffuse maculopapular eruption over the trunk and neck after the abrupt resolution of fever.^(1; 2)

CAUSES

Human herpesvirus 6 (HHV-6) is the virus that most commonly causes roseola.⁽²⁾

Other causes include:

- Human herpesvirus 7 (HHV-7)
- Enteroviruses (coxsackieviruses A and B, echoviruses)
- Adenoviruses
- Parainfluenza virus type 1⁽²⁾

TRANSMISSION

HHV-6 appears to be transmitted through the respiratory secretions of asymptomatic individuals.

In most cases, there is no reported contact with an infected individual.⁽³⁾

INCUBATION PERIOD

Approximately 9 days (range 5 to 15 days)⁽³⁾

COMMUNICABILITY

Unknown⁽³⁾

ASSESSMENT

Medication review: Review current medications, over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Usually affects children less than two years old.⁽²⁾
- The peak age of HHV-6 acquisition is 9 to 21 months.⁽⁴⁾
- Older siblings may represent a source of transmission.⁽⁴⁾

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

- Roseola is classically characterized by:
 - Sudden onset of high fever (40°C or higher), typically lasting 3 to 5 days, followed by the sudden appearance of a rash as the fever abruptly resolves.^(1; 2)
 - Prodromal symptoms of listlessness and irritability in approximately 14% of cases⁽⁶⁾
 - Non-pruritic maculopapular rash that lasts 1 to 2 days⁽³⁾
 - Febrile seizures may occur during the febrile phase of the illness.⁽³⁾
 - Diarrhea⁽⁶⁾
 - Cough⁽⁶⁾

PHYSICAL FINDINGS

Perform a physical examination using the IPPA approach.

- Child appears alert, not acutely ill⁽⁶⁾
- Rash following abrupt cessation of fever:⁽⁶⁾
 - Raised, erythematous, non-pruritic rash

- Rose-pink blanching macules and papules approximately 2 to 3 mm in diameter⁽¹⁾
- Lesions characteristically discrete, rarely coalescing together and blanching with pressure
- Typically involves the trunk or back, with minimal involvement of the face and proximal extremities
- Some lesions may be surrounded by a halo of pale skin
- Bulging anterior fontanel may be present (requires further investigation for increased intracranial pressure associated with meningitis or encephalitis)
- Nagayama's spots (erythematous papules on the soft palate and uvula)
- Periorbital edema (may occur prior to the onset of the rash)
- Conjunctival erythema⁽⁶⁾
- Associated signs and symptoms may include cervical and post-auricular lymphadenopathy, inflamed pharynx, cough and coryza⁽³⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Mononucleosis
- Erythema infectiosum (fifth disease)
- Measles (Rubeola)
- Meningitis or encephalitis
- Rubella (German measles)⁽⁷⁾
- Adverse drug reaction

Note: Roseola generally can be distinguished from other infectious exanthems and drug allergy by its epidemiology or clinical features (e.g., age group and/or the temporal relation between fever and rash).⁽²⁾

COMPLICATIONS

- Febrile seizures during febrile phase of illness⁽³⁾
- Encephalitis
- Meningitis
- Hepatitis⁽⁸⁾

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.
- Diagnostic tests are not routinely recommended.⁽⁹⁾

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Provide supportive care
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Client Education

- Encourage activity as tolerated.
- Encourage fluid intake in adequate amounts to maintain hydration.
- Reassure parent(s)/caregiver(s) of the typically benign nature of illness.
- Educate parent(s)/caregiver(s) about signs and symptoms of complications, e.g.:
 - Febrile seizure
 - Lethargy
 - Refusal to drink
 - Prolonged fever greater than 72 hours or being unable to reduce fever
- Instruct parent(s)/caregiver(s) to bring the child back to the clinic if complications arise.
- Provide education regarding how to manage a febrile seizure (for parent/caregiver information on febrile seizures, see http://www.caringforkids.cps.ca/handouts/febrile_seizures).
- Advise parent(s)/caregiver(s) that skin eruptions gradually fade and resolve without scarring.⁽⁸⁾

- Counsel parent(s)/caregivers about appropriate use of medications; dose, frequency, importance of compliance, potential side effects and interactions.
- The client should not receive any acetylsalicylic acid (ASA) or products that contain ASA. Taking ASA increases the risk of getting Reye's syndrome which can damage the liver and brain.

For additional parent/caregiver information, see <http://www.caringforkids.cps.ca/handouts/roseola> or <http://www.aboutkidshealth.ca/En/HealthAZ/ConditionsandDiseases/InfectiousDiseases/Pages/Roseola.aspx>.

PHARMACOLOGICAL INTERVENTIONS

Note: In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary.

Analgesic/ Antipyretic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen⁽¹⁰⁾

- Acetaminophen 10 to 15 mg/kg PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg/day, whichever is less.

Ibuprofen

Infants <6 months

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- • Ibuprofen 200 to 400 mg PO q4-6h PRN*

***Maximum from all sources for all ages:**

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours whichever is less. Under physician/nurse practitioner supervision, daily doses $\leq 2,400$ mg may be used.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- Monitor for seizure activity in the febrile phase of illness.
- Monitor vital signs as indicated by client's condition.
- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

The illness is usually benign and brief. Follow-up is necessary only if complications arise, e.g.,:

- Febrile seizure
- Lethargy
- Refusal to drink
- Prolonged fever greater than 72 hours or being unable to reduce fever⁽⁵⁾

Referral

- Not necessary, unless complications develop

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Health Canada. First Nations and Inuit Health Branch (FNIHB) Nursing Station Formulary and Drug Classification System. 2016 April.

RUBELLA (GERMAN MEASLES)

OVERVIEW

Please refer to provincial/territorial guidelines for Rubella where available.

Rubella (German measles) is a highly contagious, viral illness which is often mild and subclinical. Because rubella infection during pregnancy can have potentially devastating effects on the developing fetus, the rubella titre is done as part of prenatal screening. Rubella is a vaccine-preventable disease.

CAUSES

Rubella virus⁽¹⁾

TRANSMISSION

- Droplet spread⁽¹⁾
- Direct contact with nasopharyngeal secretions of infected people⁽¹⁾
- Transplacental transmission from an infected mother to her fetus⁽¹⁾

INCUBATION PERIOD

12 to 21 days from exposure to clinical illness⁽¹⁾

COMMUNICABILITY

- Communicability begins 1 week before, to at least 4 days after the onset of rash.⁽¹⁾
- Infants with congenital rubella syndrome may shed the virus for months after birth and serve as a source of infection to their contacts.⁽²⁾

ASSESSMENT

Medication review: Review current medications, over-the-counter, complementary and alternative medicines, as well as chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Individuals who have not received at least 1 dose of rubella-containing vaccine⁽²⁾
- An unborn child is at risk for congenital rubella syndrome if the mother contracts rubella during pregnancy.

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

- 1 to 5 day prodrome⁽⁴⁾
- Mild systemic signs (e.g., headache, malaise)⁽⁴⁾
- Low-grade fever⁽⁴⁾
- Arthralgia (rare in children but common in adult females)⁽⁴⁾
- Up to 50% of infections are subclinical⁽³⁾
- Immunization history, including dates and number of rubella-containing vaccine doses received.

Social History

- Travel history, including recent travel to an area with known rubella activity⁽⁵⁾

PHYSICAL FINDINGS

Perform a physical examination using the IPPA format.

- Low-grade fever⁽⁴⁾
- Conjunctivitis⁽⁴⁾
- Macular rash, which starts on face and progresses to trunk and then to the extremities. The rash becomes generalized in 24 hours and lasts an average of 3 days.⁽²⁾ The rash does not coalesce.⁽⁴⁾
- Lymphadenopathy, especially post-auricular, posterior cervical and suboccipital nodes⁽⁴⁾
- Arthritis (in adolescents)⁽⁴⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Rubeola (measles)
- Roseola
- Scarlet fever
- Erythema infectiosum (Fifth disease)
- Mononucleosis
- Unspecified viral exanthema
- Adverse drug reaction

COMPLICATIONS

Fetus

Fetal infection can occur at any stage of pregnancy. The risk of fetal damage following maternal infection is particularly high in the first trimester with progressive decline of risk thereafter.⁽¹⁾ Congenital rubella syndrome may result in any of the following fetal anomalies:

- Ophthalmologic (e.g., cataracts, microphthalmia, glaucoma)
- Cardiac (e.g., patent ductus arteriosus, peripheral pulmonary artery stenosis)
- Auditory (e.g., sensorineural hearing loss)
- Neurologic (e.g., behavioural disorders, meningoencephalitis, mental retardation)
- Hepatosplenomegaly
- Jaundice

Children

- Thrombocytopenia (hemorrhagic manifestations are rare)
- Leukopenia

Adolescents

- Arthritis (about 1 week after the rash first appears; classically, the hand, knees, wrists, and ankles are affected symmetrically)⁽⁵⁾
- Encephalitis

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Testing should be carried out as per provincial/territorial policies and procedures. Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory⁽⁷⁾

- Virus culture from clinical samples (e.g., throat swab, nasopharyngeal swab/aspirate, urine)
- Nucleic Acid Amplification Test (NAAT) (e.g., throat swab, urine) for rubella virus ribonucleic acid (RNA)
- Serum rubella Immunoglobulin M (IgM) antibody
- Serum rubella Immunoglobulin G (IgG) antibody
- If client is a female of childbearing age, determine whether she is pregnant

Interpretation of Lab Results⁽⁷⁾

In the absence of immunization with rubella-containing vaccine during the past 7 to 42 days, laboratory confirmation of infection is made with one of the following:

- Isolation of rubella virus in culture from clinical samples (throat swab, nasopharyngeal swab/aspirate, urine)
- Detection of rubella RNA by Nucleic Acid Amplification Test (NAAT)

- Positive serologic test for rubella IgM antibody in a person with an epidemiologic link to a laboratory-confirmed case or who has recently travelled to an area of known rubella activity
- A significant (four-fold or greater) rise in rubella IgG antibody levels or a seroconversion in paired acute and convalescent sera

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Provide supportive care
- Prevent disease transmission
- Prevent complications

NON-PHARMACOLOGICAL INTERVENTIONS

Client Education

- Encourage activity as tolerated
- Encourage adequate fluid intake
- Exclude children with postnatal rubella from school or child care for 7 days after the onset of the rash⁽⁶⁾
- Counsel client and parent(s)/caregivers about appropriate use of medications: dose, frequency, importance of adherence, potential side effects, interactions
- The client should not receive any acetylsalicylic acid (ASA) or products that contain ASA. Taking ASA increases the risk of getting Reye's syndrome which can damage the liver and brain.
- Counsel client to return for further assessment if there is no improvement in signs and symptoms of presenting condition.
- For client education of female patients of childbearing age, see *Prevention in Appendix, Section A* of this guideline.

Rubella Exposure/Infection in Pregnant Client⁽⁵⁾

- The management of the exposed pregnant client must be individualized and depends on when during gestation she was exposed and on her state of immunity.
- For information on prenatal diagnosis of maternal infection and congenital rubella syndrome, see *Prevention in Appendix, Section A* of this guideline.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/ nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/ territorial formulary before initiating treatment.

Antipyretic/Analgesic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen⁽⁸⁾

- Acetaminophen 10 to 15 mg/kg PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg/day, whichever is less

Ibuprofen

Infants <6 months

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*

*Maximum from all sources for all ages:

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours whichever is less. Under physician/nurse practitioner supervision, daily doses ≤2,400 mg may be used.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP⁽¹⁾

- Advise parents/caregivers to bring the child back to the clinic if there are signs of complications; complete recovery usually occurs in 1 to 2 weeks.
- For contact identification, tracing and contact management, see *Management of Contacts* in *Appendix, Section A* of this guideline.

Referral

- Arrange for medical evacuation if clinically indicated.
- Coordinate referral request(s) as required.

Reporting

Rubella is a reportable disease. Follow provincial/territorial policies and procedures for notifiable diseases.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Management of Contacts⁽²⁾

Contact Identification and Tracing

A contact of a rubella case is any susceptible person who has had close contact with the case during the period of communicability. Contact identification and tracing for rubella includes the following:

- Contact history during period of communicability
- Assessment of contact type

- Identification of contacts for follow-up and to determine the immunization status of contacts
- Occupation of contact
- Contact's residency/attendance at a facility or institution

Contact Management

- Investigate pregnant contacts for status of rubella susceptibility. Where the results are negative, perform serology to determine if infected.

Prevention

- The primary objective of vaccination against rubella is to prevent infection during pregnancy.
- The mainstay of prevention is the universal immunization of all Canadian children.⁽⁵⁾
- All females of childbearing age should be vaccinated unless they have proof of immunity either through documented evidence of prior immunization or laboratory evidence of antibodies.
- Educate women of childbearing age about the importance of knowing their rubella immunization status.⁽⁷⁾
- Screen all pregnant women to determine susceptibility to rubella and to facilitate post-partum immunization of susceptible women.⁽⁷⁾

Rubella in Pregnancy and Congenital Rubella Syndrome in Fetus⁽⁵⁾

- For detailed information about rubella in pregnancy, including congenital rubella syndrome, diagnosis of rubella infection, and management of rubella exposure/infection in pregnant women, see the latest *Society of Obstetricians and Gynaecologists of Canada (SOGC) Clinical Practice Guidelines* available from: https://sogc.org/wp-content/uploads/2013/01/guiJOG_C203CPG0802.pdf
- Assess the rubella immunity of adolescent females and women of childbearing age. Provide vaccination if necessary.

- Advise women immunized against rubella to delay pregnancy by at least 4 weeks following receipt of rubella or measles-mumps-rubella (MMR) vaccine.
- The live attenuated virus contained in the vaccine can cross the placenta; however, no case of congenital rubella has ever been reported in newborns of women who were inadvertently immunized while pregnant.
- Screen all pregnant women to determine their antibody status and their susceptibility.
- Prompt and accurate diagnosis of acute primary rubella infection in pregnancy is imperative and requires prompt serologic testing of IgM and IgG antibodies. Consult physician/nurse practitioner if rubella exposure or signs of illness suspected in a pregnant woman.
- Routine use of immune globulin to susceptible women exposed to rubella early in pregnancy is not recommended.⁽²⁾ Consult with Public Health Physician and follow provincial/territorial guidelines.

For more information, see the latest *Canadian Immunization Guide*, available from: www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php

For Children

In Canada, children should receive a 2-dose immunization schedule for rubella vaccine. For more information on immunization of children, see the latest *Canadian Immunization Guide*, available at www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php

SECTION B: SUPPLEMENTAL RESOURCES

Provincial/Territorial Guidelines

Alberta

Alberta Health and Wellness
Public Health Notifiable Disease Management Guidelines: Rubella. Available from: <https://open.alberta.ca/publications/rubella>

British Columbia

BC Centre for Disease Control
Communicable Disease Control Manual – Management of Specific Diseases German Measles/Rubella. Available from: <http://www.bccdc.ca/health-info/diseases-conditions/german-measles-rubella>

Manitoba

Public Health and Primary Health Care
Communicable Disease Management
Protocols: Rubella. Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/>

Nova Scotia

Nova Scotia Department of Health and Wellness
Nova Scotia Communicable Disease Manual: Rubella. Available from: <https://novascotia.ca/dhw/cdpc/cdc/documents/Rubella.pdf>

Northwest Territories

Northwest Territories Health and Social Services
Communicable Disease Manual. Available from: <http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Newfoundland and Labrador

Department of Health and Community Services
Newfoundland and Labrador Disease Control Manual, Section 4, Diseases Preventable by Routine Vaccination. Available from: <http://www.health.gov.nl.ca/health/publichealth/cdc/control.html>

Yukon

Yukon Health and Social Services
Yukon Communicable Disease Control: Rubella. Available from: http://www.hss.gov.yk.ca/disease_guidelines.php

Other Resources

Society Obstetricians and Gynaecologists of Canada
Clinical Practice Guidelines. Available from: https://sogc.org/clinical_practice_guidelines_eng/index.html

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OTHER SOURCES

Health Canada. First Nations and Inuit Health Branch (FNIHB) Nursing Station Formulary and Drug Classification System. 2016 April.

SCARLET FEVER

OVERVIEW

Please refer to provincial/territorial guidelines for Scarlet Fever where available.

Scarlet fever, also called scarlatina, is caused by toxin-producing strain of Group A *Streptococci* (GAS). GAS is commonly found in the throat and on the skin. Scarlet fever is a manifestation of GAS infection and usually follows GAS pharyngitis (strep throat), although it may also follow GAS infections at other sites (e.g., from *Streptococcal* skin infection (impetigo)).⁽¹⁾ Scarlet fever is characterized by a scarlatiniform rash and a strawberry-like appearance of the tongue.^(2; 9)

Other than a rash, the epidemiologic features, symptoms, signs, sequelae, and treatment of scarlet fever are the same as those of GAS pharyngitis.⁽³⁾ For more information on GAS pharyngitis see *FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 9 – Ears, Nose, Throat and Mouth – Bacterial Pharyngotonsillitis*.

CAUSES

Toxin-producing strain of Group A *Streptococci* (GAS) bacteria

TRANSMISSION

- The most common method of transmission of GAS pharyngitis and consequent scarlet fever:⁽⁴⁾
 - Person-to-person contact (spread by respiratory droplets)
- Direct contact with infected individuals⁽⁴⁾
- Less common transmission methods include:
 - Foodborne outbreaks of GAS pharyngitis occur rarely and are a consequence of human contamination of food by infected or colonized food handlers in conjunction with improper food preparation or refrigeration procedures⁽³⁾.

INCUBATION PERIOD

Usually 1 to 3 days after exposure⁽⁴⁾

COMMUNICABILITY

If untreated, a client with scarlet fever associated with GAS pharyngitis is infective during the acute phase of the illness, usually 7 to 10 days, and for 1 week afterwards; however, if antibiotics are used, the infective period is reduced to 24 hours.⁽⁴⁾

The bacterium can remain in the body in its carrier state without causing illness in the host for weeks or months and is transmissible in this state.⁽⁴⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- The main risk factor for scarlet fever is a preceding GAS infection.
- Age: GAS pharyngitis occurs predominantly in school-age children 5 to 15 years of age (although it can occur in both younger and older individuals)⁽¹⁰⁾
- Overcrowding⁽⁸⁾
- A history of GAS pharyngitis in the household, community, neighborhood, or school⁽⁵⁾

HISTORY OF PRESENT ILLNESS

- Review risk factors and collect history of present illness.
- Obtain a history of preceding sore throat/pharyngitis or skin infection⁽⁶⁾.

- The symptoms of scarlet fever are the same as those of pharyngitis alone⁽³⁾ and include the following:⁽¹⁰⁾
 - Sudden (acute) onset of sore throat
 - Fever
 - Absence of cough or rhinorrhea
 - Headache
 - Nausea, vomiting, abdominal pain
 - Rash

PHYSICAL FINDINGS

- Perform a physical examination using the IPPA approach.
- Scarlatiniform rash (see *Characteristics of Scarlatina Rash*)
- Flushed face, with circumoral pallor⁽⁷⁾
- Elevated temperature⁽¹⁰⁾
- Red pharynx with tonsillar swelling and exudate⁽¹⁰⁾
- Petechiae on the soft palate⁽¹⁰⁾
- Strawberry tongue⁽⁹⁾
- Tender anterior cervical lymphadenopathy⁽¹⁰⁾

Characteristics of Scarlatina Rash⁽⁹⁾

- Diffuse erythematous eruption
- Initially appears in the groin and axilla; the rash then extends rapidly over the entire body to finally involve the extremities
- The rash is more marked along the skin folds of the inguinal, axillary, antecubital, and abdominal areas.
- Often exhibits linear petechiae in the antecubital fossae and axillary folds (Pastia's lines)
- Palms and soles are usually spared
- The numerous small papular lesions give the skin the texture of coarse sandpaper.
- Erythema blanches with pressure
- The rash begins to fade within 4 to 5 days and is followed by desquamation on the body and extremities, with peeling from the palms/fingers and soles/toes.⁽⁷⁾

Appearance of Tongue⁽⁷⁾

- During the first few days of the disease, the tongue has a white coating through which the red, edematous papillae project; this phase is referred to as 'white strawberry tongue.'
- After 3 to 4 days, the tongue also desquamates, which results in a red tongue with prominent papillae, referred to as 'red strawberry tongue'.

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Drug hypersensitivity⁽⁷⁾
- Infectious mononucleosis⁽⁷⁾
- Various viral exanthems⁽⁷⁾

COMPLICATIONS

Those at increased risk for acute rheumatic fever include:⁽¹⁶⁾

- Past history of acute rheumatic fever, especially with carditis or valvular disease
- Household contact with someone having a history of rheumatic fever (*for more information, see FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 11 – Cardiovascular System – Rheumatic Fever (Carditis)*). For more information on suppurative and non-suppurative complications, see Table 1.

TABLE 1
Non-suppurative and Suppurative Complications⁽⁹⁾

NON-SUPPURATIVE COMPLICATIONS	SUPPURATIVE COMPLICATIONS
<ul style="list-style-type: none"> - Acute rheumatic fever (may occur an average of 19 days following infection) - Rheumatic heart (valvular) disease (may occur days to weeks after acute infection) - Streptococcal toxic shock syndrome - Acute glomerulonephritis (may occur an average of 10 days following infection) - Pediatric Autoimmune Neuropsychiatric Disorder associated with GAS (PANDAS) (research is ongoing/controversial; see <i>Appendix, Section A: Clinical Management Information - PANDAS</i>) - Sydenham chorea (may occur several months following infection) 	<ul style="list-style-type: none"> - Tonsillopharyngeal cellulitis or abscess - Otitis media - Sinusitis - Necrotizing fasciitis - Streptococcal bacteremia (rare) - Meningitis or brain abscess (complication resulting from direct extension of an ear or sinus infection or from bacteremic spread)

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Diagnostic testing is based on client history, risk factors, physical examination findings and test availability. Testing should be carried out as per provincial/territorial policies and procedures.
- When scarlet fever is suspected, laboratory diagnosis of a GAS infection is performed to confirm the diagnosis.

Laboratory

- Rapid Antigen Detection Test (RADT) (if available). A positive RADT is considered definitive for GAS.⁽¹⁰⁾
- Throat swab for culture and sensitivity (C+S) if RADT is negative or unavailable.⁽¹⁰⁾
- Wound swab for C+S if scarlet fever is due to a GAS skin infection.⁽⁷⁾

For more information on diagnostic tests for GAS pharyngitis see *FNIHB Pediatric and Adolescent Care Clinical Practice Guidelines – Chapter 9 – Ears, Nose, Throat and Mouth – Bacterial Pharyngotonsillitis*.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Prevent rheumatic fever and suppurative complications⁽¹⁰⁾
- Prevent spread of GAS infection to others⁽¹⁰⁾
- Relieve symptoms⁽¹⁰⁾

NON-PHARMACOLOGICAL INTERVENTIONS

Interventions

- Appropriate monitoring of individuals in the community with respect to complications

Client Education

- Encourage rest.
- Encourage fluids in adequate amounts to maintain hydration.
- To minimize the risk of transmission, advise parent(s)/caregiver(s) or client to:
 - Wash hands regularly
 - Not share eating or drinking utensils
 - Use tissues to cover the mouth and nose if coughing or sneezing
 - Dispose used tissues immediately after use to prevent contamination⁽⁶⁾

- Advise parent(s)/caregiver(s) or client that the client should not return to school or daycare until the first 24 hours of antibiotic therapy is complete.⁽⁹⁾
- Emphasize the importance of observing for the warning signs and symptoms of complications of GAS infections.
- Advise parent(s)/caregiver(s) to promptly bring the client back to the clinic for re-assessment if child has any of the warning signs and symptoms of complications at any point during the course of the illness.
- Counsel parent(s)/caregiver(s) or client about appropriate use of medications: dose, frequency, importance of adherence, potential side effects and interactions.
- Advise parent(s)/caregiver(s) that the child must complete the entire course of antibiotics, even if symptoms resolve.
- If a client with confirmed GAS pharyngitis remains symptomatic on appropriate antibiotic therapy after 48 hours, the client should be reassessed for such factors as acute complications of GAS pharyngitis (e.g., peritonsillar abscess, concurrent viral infections and antibiotic adherence or antibiotic failure).
- Other indications to start antibiotics empirically include:
 - Client appears acutely ill
 - Client is symptomatic and has had contact with a documented case of GAS pharyngitis
 - Client has pharyngitis complications, e.g. early peritonsillar abscess
- In consultation with the physician/nurse practitioner, discontinuation of empiric therapy may be appropriate for client with suspected GAS pharyngitis if the throat culture is available and yields no growth⁽¹¹⁾.

Indications to Delay Therapy Pending Culture Results in Clients with Suspected GAS Pharyngitis

For populations at low risk for acute rheumatic fever, and in the absence of other indications for empiric therapy, delaying antibiotic therapy is unlikely to increase the risk of acute rheumatic fever as long as treatment of GAS pharyngitis is initiated within 9 days of onset of illness. This approach also minimizes the number of clients being treated unnecessarily before the test results are available⁽¹²⁾.

Note: In some exceptional circumstances, however, where it may be very difficult to contact the client for follow-up, it may be appropriate to initiate antibiotic therapy.

Note: If RADT is positive (if available), treat client immediately.

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary before initiating treatment.

Antibiotic Therapy

Antibiotics are indicated in scarlet fever in order to treat the underlying GAS infection and to prevent other complications.

Indications for Empiric Therapy in Clients with Suspected GAS Pharyngitis

- For those at high risk of acute rheumatic fever, consult with a physician/nurse practitioner to initiate antibiotic treatment immediately while awaiting culture results.

Preferred Treatment

Consider one of the following:

Penicillin

Child less than/equal to 27 kg

- Penicillin V 300 mg PO BID for 10 days⁽¹³⁾

Child greater than 27 kg

- Penicillin V 600 mg PO BID for 10 days⁽¹³⁾

Amoxicillin

- Amoxicillin 50 mg/kg/dose PO daily for 10 days; maximum 1,000 mg in 24 hours⁽¹⁰⁾

or

- Amoxicillin 25 mg/kg/dose PO BID for 10 days; maximum 500 mg/dose⁽¹⁰⁾

Note: Amoxicillin should not be used prior to a confirmatory diagnosis of GAS pharyngitis because it can induce rash with some viral infections.

Alternate Treatment: If Known or Suspected Non-Anaphylactic Allergy to Penicillin⁽¹⁰⁾

Cephalexin

- Cephalexin 20 mg/kg/dose PO BID for 10 days; maximum 500 mg/dose

Alternate Treatment: If Known or Suspected Anaphylactic Allergy to Penicillin or Cephalosporin⁽¹⁰⁾

Clindamycin

- Clindamycin 7 mg/kg/dose PO TID for 10 days; maximum 300 mg/dose

Alternate Treatment: If Medication Compliance or Follow-up is a Concern⁽¹⁰⁾

If medication compliance or follow-up is a concern, benzathine penicillin G IM for one dose may be given. Benzathine penicillin G may be obtained through the Non-Insured Health Benefits Program, if not available through provincial/territorial formulary. It is not listed in the FNIHB Nursing Station Formulary.

Analgesic/Antipyretic**Acetaminophen⁽¹⁴⁾**

- Acetaminophen 10 to 15 mg/kg/dose PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg in 24 hours, whichever is less

Ibuprofen**Infants <6 months**

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*

***Maximum from all sources:**

Ibuprofen 40 mg/kg in 24 hours or 2,400 mg in 24 hours, whichever is less

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes
- Monitor vital signs as indicated by client's condition
- Monitor for symptoms of:
 - Airway distress and/or obstruction
 - Tripod positioning
 - Stridor
 - Dysphagia
 - Drooling or anxiety

FOLLOW-UP

The client diagnosed with scarlet fever will be assessed as follows to monitor response to therapy and to monitor for complications.

For All Clients

- At any time if the client is getting worse
- In 2 to 3 days to monitor for medication adherence and clinical response to therapy or to check for throat C+S test result
- If client is identified as being at increased risk of any complications
- Following a course of antimicrobial therapy if there is a recurrence of symptoms compatible with GAS infection.

Note: Clinical response to appropriate antimicrobial treatment is usually evident within 24–48 hours. Persistence of high fever and severe symptoms beyond this period indicates the need for reassessment and is suggestive of the development of complication(s) or another underlying disease. Antibiotic failure is also a possibility.

Follow-up for Clients at High Risk for Acute Rheumatic Fever

In addition to the preceding, for clients diagnosed with scarlet fever due to GAS pharyngitis, follow-up throat cultures are recommended after a course of appropriate antibiotic treatment for clients at high risk of acute rheumatic fever.

Note: Acute rheumatic fever presents days to weeks after an acute GAS infection (most often GAS pharyngitis).

Referrals

- Arrange for medical evacuation if clinically indicated.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Pediatric Autoimmune Neuropsychiatric Disorder (PANDAS)^(16; 17)

PANDAS has been characterized as the abrupt, dramatic onset of obsessive-compulsive disorder (including severely-restricted food intake) or tics in some children as an autoimmune response following a GAS infection. The concept of PANDAS as a distinct disease entity is controversial and research is ongoing. At present, there is insufficient evidence to support routine testing for GAS in children with neuropsychiatric symptoms, or to support long-term prophylaxis or immune-modifying therapies in children with neuropsychiatric symptoms. Any child presenting with acute-onset obsessive-compulsive disorder/eating disorders must have a thorough medical evaluation.

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TUBERCULOSIS

OVERVIEW

Please refer to provincial/territorial guidelines for tuberculosis where available.

Tuberculosis (TB) is an infectious bacterial disease that most commonly affects the lungs, although other organs may be involved (nonrespiratory TB).⁽¹⁾ In Canada, TB in the pediatric population is largely a disease of Canadian-born Aboriginal and foreign-born children.⁽²⁾

TB in children differs from that in adults in the following ways:⁽²⁾

- Diagnosis in young children may be difficult, since the signs and symptoms are often non-specific and disease is often paucibacillary (contain few bacilli). As a result, many children with TB disease are asymptomatic at presentation.
- In children under 5, especially infants, there is a high risk of progression from latent TB infection (LTBI) to active and sometimes severe TB disease, including miliary/disseminated and TB meningitis.
- Because TB in children can quickly become a medical emergency, children identified as contacts of active cases in adolescents or adults should be considered a high priority for screening and follow-up.⁽³⁾

Active TB in children is a sentinel event that should prompt a search for the source case.⁽²⁾

CAUSES

Mycobacterium tuberculosis⁽²⁾

For detailed information on the sub-classification and clinical presentation of TB, see *FNIHB Adult Care Clinical Practice Guidelines – Chapter 11 – Communicable Diseases – Tuberculosis*.

TRANSMISSION

Transmission by adults or adolescents with infectious pulmonary, laryngeal and/or cavitary TB is airborne. Bacilli in minute droplets of moisture (droplet nuclei) are inhaled by children and go on to produce TB infection or disease. TB is rarely acquired by ingestion or percutaneously.⁽⁴⁾ The likelihood of transmission increases if the source individual:⁽⁴⁾

- Has a frequent and severe cough
- Has had close and prolonged contact with the child
- Lives or works in crowded conditions with poor ventilation

The most effective methods for reducing risk of transmission are:⁽⁴⁾

- Early diagnosis and treatment of clients with active TB and
- following infection prevention and control procedures

COMMUNICABILITY

- Children younger than 10 years of age with respiratory TB are rarely contagious because their cough is non-productive, which results in few or no expelled bacilli.^(2; 5; 4)
- LTBI is not communicable.⁽⁶⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake which may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

- Active TB cases in community⁽⁴⁾
- Crowding and poor ventilation⁽⁴⁾
- HIV⁽⁴⁾
- Age (children less than 5 years of age have a higher morbidity risk)⁽⁴⁾
- Immunocompromised⁽⁴⁾
- Severe malnutrition⁽⁴⁾
- Individuals who are homeless or under-housed⁽⁷⁾
- Aboriginal children living in communities with high rates of LTBI or TB disease⁽⁷⁾

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

Asymptomatic Client

Many children with TB disease are asymptomatic at presentation. They are often identified through active case finding as contacts of clients with infectious TB and are found to have abnormal chest x-rays, especially if the child is under 5 years of age.⁽²⁾

Symptomatic Client

Children may also present with signs or symptoms suggestive of disease. In most cases, children with symptomatic TB develop chronic, unremitting symptoms that persist for more than 2 weeks without sustained improvement or resolution following appropriate treatment for other potential diagnoses (e.g., antibiotics for pneumonia.)⁽⁸⁾ The following may be reported by the parent(s)/caregiver(s)/client:⁽⁸⁾

- Cough
- Fever
- Poor appetite/anorexia
- Weight loss or failure to thrive
- Fatigue, reduced playfulness, decreased activity

Past Medical History

- Exposure to TB⁽⁴⁾
- History of active TB and questionable adequacy of previous treatment⁽⁴⁾
- History of positive Tuberculin Skin Test (TST) and questionable prophylaxis adequacy (if the client previously received LTBI prophylaxis)⁽⁴⁾

PHYSICAL FINDINGS

- Perform a physical examination using the IPPA approach.
- In infants and young children, physical findings may be very non-specific:⁽²⁾
 - Hepatosplenomegaly
 - Respiratory distress
 - Fever
 - Lymphadenopathy
 - Abdominal distention
 - Lethargy
 - Irritability
- Older children and adolescents are more likely to experience adult-type disease and often present with the classic triad of:⁽²⁾
 - Fever
 - Night sweats
 - Weight loss
 - Respiratory symptoms (e.g., cough, sputum and sometimes hemoptysis)

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Pneumonia⁽⁹⁾
- Generalized bacterial and viral infections⁽⁹⁾
- Malnutrition⁽⁹⁾

COMPLICATIONS

Primary infection may be associated with complications, especially in children under 5 years of age.

- The parenchymal lesion may enlarge and caseate, or nodes may enlarge and compress or erode through a bronchus, causing:⁽²⁾
 - Wheezing
 - Segmental pneumonia
 - Atelectasis
- Severe forms of TB disease, including CNS TB and miliary TB⁽²⁾
- Death

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration when there are no provincial/territorial policies available.

TST and IGRA⁽²⁾

- In children, the TST and IGRA is an important part of the clinical case definition of TB disease, particularly for LTBI.
- Culture yield in children is low; in addition to compatible clinical signs or symptoms,⁽²⁾ TB often is diagnosed by the combination of:
 - A positive TST or IGRA
 - Abnormal chest x-ray
 - A history of a contact case of infectious TB

Positive TST or IGRA⁽²⁾

- A positive TST or IGRA does not distinguish between LTBI and active disease.

Negative TST⁽²⁾

- A negative TST does not exclude TB disease.

For specific recommendations for using the TST and IGRA in children, see *Table 1: Recommendations for using the TST and IGRA in Children* in *Appendix, Section A* of this guideline.

Recommended samples

Note: Sputum may be difficult to obtain from children and gastric aspiration or sputum induction may be required.⁽²⁾

- Three 5 to 10 mL sputum samples (one of which should be an early morning specimen, if possible) for:⁽¹⁰⁾
 - Acid-fast bacilli (AFB) and
 - *M. tuberculosis* culture +/- PCR
- 3 sputum specimens can be provided by the client on the same day, at least 1 hour apart, in a well ventilated area or outdoors.

For additional information on collection of sputum samples, see *FNIHB Adult Care Clinical Practice Guidelines – Chapter 11 – Communicable Diseases – Tuberculosis*.

Additional Lab Investigations⁽¹⁾

- CBC
- Creatinine
- Liver function tests (e.g., ALT, AST, bilirubin)
- HIV serology

X-ray

X-ray may be required to confirm a diagnosis⁽¹⁰⁾ or to monitor response to treatment.⁽¹¹⁾ Frequency of films will vary and are at the discretion of the attending respirologist or TB expert.

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Ensure adequate treatment of active disease; treatment is for the purpose of:⁽²⁾
 - Reducing morbidity and mortality
 - Interrupting transmission
 - Preventing acquired resistance
 - Providing a lasting cure
- Identify case contacts through reverse contact tracing (i.e., a vigorous search should be carried out for the source case)⁽²⁾; for more information, see *Appendix, Section A* in this guide.

NON-PHARMACOLOGICAL INTERVENTIONS

Interventions

Note: If a case of latent or active TB is confirmed, the local Public Health Physician should be notified.⁽¹⁾

- A diagnosis of TB infection or disease in a child should be considered a sentinel event and prompt the search of the source case, most likely an adult or adolescent in close contact with the child.⁽²⁾ For more information, see *Management of Contacts in Appendix, Section A* of this guideline.
- Close caregivers should be evaluated to rule out TB disease.⁽²⁾
- Consideration should be given to placing all close caregivers in isolation until they have been evaluated.⁽²⁾ For information on home isolation recommendations, see *FNIHB Adult Care Clinical Practice Guidelines – Chapter 11 – Communicable Diseases – Tuberculosis*.

Client Education

- Provide parent(s)/caregiver(s)/client with information about:
 - TB
 - The signs and symptoms of TB
 - The difference between TB disease and LTBI
 - The expected treatment plan

When to return to the clinic or seek medical attention

- Encourage parent(s)/caregiver(s)/client to return to the clinic and/or seek medical attention as soon as possible if any of the following symptoms occur:^(1: 2)
 - Anorexia
 - Nausea or vomiting
 - Abdominal discomfort
 - Unexplained fatigue
 - Signs of hepatotoxicity (dark coloured urine, jaundice)
- Provide parent(s)/caregiver(s)/client with a clear written plan of action, including contact telephone numbers, should symptoms arise.⁽²⁾

Treatment

- Explain the purpose, process and importance of directly observed treatment (DOT).
- Stress the importance of strict adherence to medication regimen to ensure cure of TB and to prevent drug resistance.
- Encourage use of DOT to promote adherence and monitoring.
- Advise parent(s)/caregiver(s)/client to maintain an optimum state of health with adequate nutrition and rest.⁽¹²⁾

Medication

Counsel parent(s)/caregiver(s)/client about:

- Appropriate use of medications; dose, frequency, importance of adherence, potential side effects and interactions and detection of side effects before the next scheduled appointment.

- Potential side effects of first-line antituberculosis therapy (for more information, see *Table 3: Possible Adverse Events of First-line Antituberculosis Therapy* in *Appendix, Section A* of this guideline)
- Significant drug-drug and drug-food interactions with TB medications (for more information, see *Heartland National TB Centre's Tuberculosis medication drug and food interactions*, available from: http://www.heartlandntbc.org/assets/products/tuberculosis_medication_drug_and_food_interactions.pdf)
- Access to clinicians and the health service, particularly if there are language and social barriers.⁽²⁾

For more client information topics, see Health Canada's *Tuberculosis is Curable, Information about TB*, available from: http://www.hc-sc.gc.ca/fniah-spnia/alt_formats/pdf/diseases-maladies/tuberculos/factsheet-fiche-fn-pn-eng.pdf

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary before initiating treatment.

Active Disease

TB medications are routinely prescribed by a pediatric TB specialist. In some provinces/territories however, they may be initiated and/or prescribed by an alternate physician/nurse practitioner. All oral TB medications are provided to clients through Provincial/Territorial Public Health Programs.

Children under 5 years of age are at high risk of progressing to severe forms of TB after they have been infected with TB. If TB is suspected in children, consult with TB specialists or physician/nurse practitioner immediately in order to initiate presumptive therapy, as necessary.⁽²⁾

Symptomatic children

No source case isolate available

- For children who are symptomatic and for whom no source case isolate is available, obtain specimens for culture and drug susceptibility testing prior to initiating presumptive therapy for active disease.⁽²⁾

Known source case

- For children who are symptomatic and for whom a known source case is available, use the culture and susceptibility test results of the known source case to guide therapy (provided there is no possibility of alternative sources).⁽²⁾

First-line treatments

Unless contraindicated, empiric first-line treatments are typically comprised of:⁽²⁾

- Isoniazid (INH)
- Rifampin (RMP)
- Ethambutol (EBM) and
- Pyrazinamide (PZA)

For medication dosages in children, see *Table 2* in *Appendix, Section A* of this guideline.

Asymptomatic children

Presumptive therapy

To prevent the development of active TB, an 8-week course of presumptive therapy for latent tuberculosis infection (LTBI) is recommended for children under 5 years of age who:⁽²⁾

- Have been exposed to a close contact with active TB
- Are asymptomatic
- Have a negative TST

For recommended medication and dos-age, see the *Latent Tuberculosis Infection (LTBI)* section of this guideline.

Negative TST⁽²⁾

Note: It may take 8 weeks after infection for TST to convert positive, during which time the disease may progress to active disease.

- If the child is asymptomatic, and TST is still negative after 8 weeks, consult with TB specialists or physician/nurse practitioner in consideration of stopping the medication, particularly for immunocompetent children who are 6 months of age and older.

Isoniazid (INH) and Pyridoxine (Vitamin B6)

- When isoniazid (INH) is prescribed, vitamin supplementation with pyridoxine (vitamin B6) should also be prescribed because of the increased risk of symptoms related to pyridoxine deficiency, especially in children with diabetes, renal failure, malnutrition, seizure disorders, HIV infection and/or adolescents who are pregnant and/or breastfeeding, or have substance abuse
- Pyridoxine supplement is also indicated for children with meat-and milk-deficient diets, as well as breastfed infants.⁽²⁾

Pyridoxine

- Pyridoxine PO daily 25 mg
- (calculate 1 mg/kg/dose; Maximum 25 mg/dose)

Note: Pyridoxine dose of 25 mg per day is sufficient as higher dose may interfere with INH activity.

Children with suspected TB meningitis

- For children in whom TB meningitis is suspected, an anti-inflammatory such as dexamethasone or prednisone may be initiated by the TB specialists or physician/nurse practitioner.⁽²⁾

Ethambutol (EMB)

Ethambutol (EMB) should be discontinued as soon as drug susceptibility testing (DST) result is available indicating that the bacterium is fully susceptible, or if the source case is known to be fully drug-susceptible.⁽²⁾

Treatment length

- Treatment length will vary depending on the TB infection sites, prescribed anti-TB medication regimen, disease severity and client risk factors.⁽¹³⁾

Initiating TB therapy⁽²⁾

- Initiating TB therapy requires the client to be followed closely to monitor and minimize the risk of toxicity and to ensure that therapy is completed.
- For effective TB treatment, 100% of prescribed doses must be taken.
- DOT is strongly recommended for the full duration of therapy for pediatric clients. Consider alternate methods for DOT (e.g., videoconference) where available.
- When treating TB, the most important element of the treatment is ensuring the actual ingestion of the medication by the child. Children may not tolerate the medication and the existing formulations are not particularly child-friendly.

Phases of therapy

Active disease therapy always consists of multiple drugs for 6 months or longer. Therapy is initiated in two phases:

- The initial phase, which lasts 2 months
- The continuation phase, which lasts 4 months or longer

Initial Phase of Treatment (duration: 2 months)⁽¹¹⁾

- In the initial phase of active TB treatment, at least 3 effective medications should be prescribed if the client's infection is fully susceptible:
 - INH
 - Rifampin
 - Pyrazinamide
- Pyrazinamide (PZA) is the most toxic of the standard first-line drugs and the most common cause of drug-induced hepatotoxicity in clients treated for TB disease.
- Clients at risk of hepatotoxic effects such as those with a history of alcoholism, and/or pre-existing mild to moderate liver dysfunction may not tolerate this agent.
- If drug-resistant infection is suspected or confirmed, expert consultation is strongly advised.

Continuation Phase of Treatment (duration: 4 months or longer)⁽¹¹⁾

- Treatment of active TB should have at least 2 effective medications in the continuation phase.
- If TB medications are to be given intermittently (for example, on a schedule of 3 times a week during the continuation phase), then the client must be fully supervised for DOT.
- Prolonging the continuation phase beyond 4 months (in which case the total course of treatment would be beyond 6 months) is recommended in the following circumstances:
 - When there is persistent presence of cavity on the chest x-ray after 2 months or at the end of effective anti-TB therapy
 - When there is persistent smear and/or culture positivity after 2 months of therapy
 - When the child is infected with HIV

- When the child has a non-respiratory TB infection (i.e., meningeal TB) (for more information on non-respiratory tuberculosis,⁽¹³⁾ refer to *Canadian Tuberculosis Standards, 7th edition*, Chapter 7, *Nonrespiratory Tuberculosis*, available from: <https://www.canada.ca/en/public-health/services/infectious-diseases/canadian-tuberculosis-standards-7th-edition/edition-19.html>
- If second-line regimens are required and particularly if drug-resistant TB is identified⁽¹⁵⁾ (for additional information regarding the different types of drug resistance, refer to the *Canadian Tuberculosis Standards, 7th edition*, Chapter 8, *Drug Resistant Tuberculosis* available from <https://www.canada.ca/en/public-health/services/infectious-diseases/canadian-tuberculosis-standards-7th-edition/edition-20.html>

Latent Tuberculosis Infection (LTBI)

Treatment regimens for LTBI may vary according to provincial/territorial treatment guidelines. TB control offices are to be consulted for further information.

Duration

- The current recommended standard of treatment for LTBI is INH for 9 months daily.⁽²⁾

Rifampin

If the source case is INH-resistant or there is epidemiologic reason to suspect that the child is infected with an INH-resistant strain, then rifampin is recommended for 4 months.⁽²⁾

Note: When isoniazid (INH) is prescribed, vitamin supplementation with pyridoxine (vitamin B6) should also be prescribed because of the increased risk of symptoms related to pyridoxine deficiency, especially in children with diabetes, renal failure, malnutrition, seizure disorders, HIV infection, and/or adolescents who are pregnant and/or breastfeeding, or have substance abuse. Pyridoxine supplement is also indicated for children with meat-and milk-deficient diets, and breastfed infants.

Pyridoxine

- pyridoxine PO daily (calculate 1 mg/kg/dose; Maximum 25 mg/dose)

Note: Pyridoxine dose of 25 mg per day is sufficient as higher dose may interfere with INH activity.

-For detailed information on the use of shorter rifampin based regimens for the treatment of LTBI, see *Table 4* in *Canadian Tuberculosis Standards, 7th edition, Chapter 6, Treatment of Latent Tuberculosis Infection*.

-Additional therapeutic options may include rifapentine and INH for a 3 month course.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.

FOLLOW-UP

- Follow-up at least monthly during active TB treatment to assess for adherence, response to treatment and enquire about adverse events.⁽¹¹⁾
- Response to treatment should be gauged clinically, radiographically and microbiologically.⁽¹¹⁾
- Microbiologic monitoring is considered the most reliable.⁽¹¹⁾
- Consult provincial/territorial policies and procedures for additional guidance.
- Repeat sputum cultures are not necessary if the child is improving clinically.⁽²⁾
- For adolescents or older children with adult-type disease, follow-up sputum examinations should be performed in the same way as for adults (for more information, see *FNIHB Adult Care Clinical Practice Guidelines – Chapter 11 – Communicable Diseases – Tuberculosis*).

- Chest x-ray 2 months into treatment is recommended to rule out extension of disease.⁽²⁾
- Liver function tests and the client's weight should be checked regularly, as per physician/nurse practitioner direction.
- If any changes in weight are noted during subsequent follow-up visits, consult with physician/nurse practitioner to ensure medications are adjusted appropriately based on weight.⁽²⁾
- Follow-up at least 1 year after treatment is completed.⁽²⁾

Clients on Ethambutol (EMB)

- Clients receiving ethambutol should have a baseline visual acuity and red-green color discrimination screen monthly (frequency may vary according to the provincial/territorial treatment guidelines and/or the treating physician/nurse practitioner).⁽¹¹⁾
- Clients who take ethambutol for longer than just the initial phase of treatment should be referred to an ophthalmologist for periodic assessment of visual acuity, colour vision and visual fields.⁽¹¹⁾

Referral

- Coordinate referral request to a pediatric infectious disease specialist.⁽¹⁾
- Clients with suspected active TB may require medical evacuation for investigation and treatment.
- If suspected or confirmed active TB, clients may need to follow additional precautions during transportation; refer to provincial/territorial policies and procedures for guidance.

Reporting

TB is a reportable disease.⁽¹⁴⁾ Follow provincial/territorial policies and procedures for notifiable diseases.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

Management of Contacts⁽²⁾

- The most efficient way to prevent pediatric TB is the prompt evaluation and treatment of children exposed to an infectious adult source case. Missed opportunities to prevent cases of pediatric TB include:
 - Delayed diagnosis of infectious TB
 - Delayed reporting of a source
 - Failure to identify an exposed child during the contact investigation
 - Failure to achieve adherence of the source case
 - Failure to document sterilization of cultures
 - Failure to start preventive therapy or LTBI treatment in the child.
 - Failure to ensure that the child takes treatment
- With each pediatric active TB case, the case management team should determine which of these factors may have played a role in the child becoming infected with TB and take corrective action to prevent future cases.
- All exposed children should have a symptom inquiry and TST.
- Children less than 5 years of age, all close childhood contacts and all symptomatic children should also have a physical examination and chest radiography.
- Children less than 5 years of age with a new negative TST and no evidence of active TB by examination or radiologist should be given ‘window’ of preventive therapy to prevent the development of TB. This is because it may

take up to 8 weeks after infection for the TST to convert to positive, during which time the infection may progress to active disease.

- For children presumed to have been exposed to a drug-susceptible isolate, INH is recommended. The INH may be discontinued if, after a period of eight weeks after the last contact, the repeat TST is negative, and the child remains asymptomatic and is immunocompetent and more than 6 months of age.
- In the exposed child, if the TST is positive and there is no clinical or radiographic evidence of disease, then a full course of treatment for LTBI is recommended.
- When a child with new, active TB is the index case, reverse contact tracing must be undertaken.

Reverse Contact Tracing⁽²⁾

- Reverse contact tracing involves a vigorous search for the source case.
- Although most source cases are found among adolescent or adult household contacts of the child, other source cases are found among adolescent or adult non-household contacts, such as babysitters and other caregivers either in or outside the household.
- Molecular characterization of *M.tuberculosis* isolates by genotyping can lead to identification of previously unrecognized source case.
- If the child is hospitalized, it is advisable to screen adolescent or adult visitors for evidence of active TB.

Tuberculin Skin Test and Interferon Gamma Release Assay in Children

TABLE 1

Recommendations for using the TST and IGRA in Children⁽¹⁾

TEST	RECOMMENDED POPULATION
TST preferred (IGRA acceptable)	Children < 5 years of age
IGRA preferred, where available (TST acceptable)	Children ≥ 5 years of age who have received BCG vaccine Children ≥ 5 years of age who are unlikely to return for a TST reading

For additional information on the TST and IGRA see *FNIHB Adult Care Clinical Practice Guidelines – Chapter 11 – Communicable Diseases – Tuberculosis*.

TABLE 2

Dosages for First Line Antituberculosis Medications in Children⁽²⁾

MEDICATIONS	USUAL DAILY DOSES
Isoniazid	10 mg/kg, maximum 300mg
Rifampin	15 mg/kg, maximum 600 mg
Pyrazinamide	35 mg/kg, maximum 2000 mg
Ethambutol	20 mg/kg, maximum 1600 mg

Monitoring For Adverse Events to Antituberculosis Therapy

TABLE 3

Possible Adverse Events of First-line Antituberculosis Therapy⁽¹¹⁾

MEDICATIONS	COMMON ADVERSE EVENTS	UNCOMMON BUT IMPORTANT ADVERSE EVENTS
Isoniazid	Rash, hepatitis, neuropathy	Central nervous system toxicity, anemia
Rifampin	Drug interactions, rash	Hepatitis, flu-like illness, neutropenia, thrombocytopenia
Pyrazinamide	Hepatitis, rash, arthralgia	Gout
Ethambutol	Eye toxicity	Rash

Prevention⁽¹⁶⁾

- Bacille Calmette-Guérin (BCG) is the only vaccine currently used for the prevention of miliary TB and TB meningitis, for which infants and young children are at increased risk.
- Currently, the National Advisory Committee on Immunization (NACI) does not recommend BCG vaccination for all Canadians; however, it does for infants in First Nations and Inuit communities or groups of persons with an average annual rate of smear-positive pulmonary TB greater than 15 per 100,000 (all ages) population during the previous 3 years OR with an annual risk of TB infection > 0.1% if early identification and treatment of TB infection is not available.

Indications for BCG Vaccination

- BCG vaccination is currently recommended in high-incidence communities for infants in whom there is no evidence of HIV infection or immunodeficiency.
- If vaccination is delayed beyond 6 months of age, a TST should be done and documented as negative before vaccination.
- For infants aged between 2 and 6 months, an individual assessment of the risk and benefit of TST prior to BCG vaccination is indicated.
- For more information on the BCG, see the *Canadian Immunization Guide: Part 4 – Active Vaccines Bacille Calmette Guérin (BCG) Vaccine*, available from: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-2-bacille-calmette-guerin-vaccine.html>

Contraindications for BCG Vaccination

- Immune deficiency diseases, including congenital immunodeficiency, HIV infection, altered immune status due to malignant disease and impaired immune function secondary to treatment with corticosteroids, chemotherapeutic agents or radiation.

- Infants:
 - HIV-positive status of mother
 - Family history of immunodeficiency
- Individuals with extensive skin disease and burns
- Positive TST result
- Persons with severe acute illness (persons with minor or moderate acute illness (with or without fever) may be vaccinated)

SECTION B: SUPPLEMENTAL RESOURCES**Provincial/Territorial Guidelines****Alberta**

Alberta Health and Wellness
Tuberculosis Prevention and Control Guidelines for Alberta. Available from: <https://open.alberta.ca/publications/tuberculosis-prevention-and-control-guidelines-for-alberta>

British Columbia

BC Centre for Disease Control
Chapter 4: Tuberculosis Manual. Available from: <http://www.bccdc.ca/health-professionals/clinical-resources/communicable-disease-control-manual/tuberculosis>

Manitoba

Public Health Branch
Communicable Disease Control - Manitoba Tuberculosis Protocol. Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/tb.pdf>

Newfoundland and Labrador

Department of Health and Community Services
Guideline for Preventing the Transmission of Mycobacterium tuberculosis across the Continuum of Care. Available from: http://www.health.gov.nl.ca/health/publichealth/cdc/tuberculosis_management.pdf

Northwest Territories

Northwest Territories Health and Social Services NWT Tuberculosis Manual. Available from: <http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Nova Scotia

Nova Scotia Department of Health and Wellness Communicable Disease Prevention and Control, Tuberculosis. Available from: <https://novascotia.ca/dhw/CDPC/tuberculosis.asp>

Ontario

Ontario Ministry of Health and Long-Term Care Ontario Public Health Standards: Tuberculosis Prevention and Control. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/protocols_guidelines/Tuberculosis_Prevention_And_Control_Protocol_2018_en.pdf

Saskatchewan

Government of Saskatchewan Tuberculosis. Available from: <https://www.saskatchewan.ca/residents/health/diseases-and-conditions/tuberculosis>

Yukon

Yukon Health and Social Services TB Control Manual. Available from: <http://www.hss.gov.yk.ca/tbmanual.php>

Other Resources

Alvarez GG, Orr P, Wobeser WL, Cook V, Long R. Chapter 14: Tuberculosis Prevention and Care in First Nations, Inuit and Metis Peoples. In: Canadian Tuberculosis Standards. 7th ed. [Internet]. Her Majesty the Queen in Right of Canada; 2014. Available from: <http://www.phac-aspc.gc.ca/tbpc-latb/pubs/tb-canada-7/index-eng.php>

Rifampin 25mg/mL oral suspension. [Internet] Toronto, ON: SickKids Pharmacy; 2007 August. Available from: <http://www.sickkids.ca/pdfs/Pharmacy/2692-Rifampin.pdf>

Pyrazinamide 100mg/mL oral suspension. [Internet] SickKids Pharmacy. Toronto, ON: SickKids Pharmacy; 2007 April. Available from: <http://www.sickkids.ca/pdfs/Pharmacy/2690-pyrazinamide.pdf>

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Canadian Pharmacists Association. Pyridoxine (Vitamin B6). [Internet] Ottawa, ON: e-Therapeutics; 2012. Available from: <http://www.e-therapeutics.ca> with authorized username and password.

Health Canada. First Nations and Inuit Health Branch (FNIHB) Nursing Station Formulary and Drug Classification System. 2016 April.

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MENINGITIS

OVERVIEW

Please refer to provincial/territorial guidelines for Meningitis where available.

Meningitis is a medical emergency. All clients with suspected meningitis must be medically evacuated as soon as possible. Consult with a physician/nurse practitioner immediately.

Meningitis is inflammation of the meningeal membranes of the brain or spinal cord. Although viral meningitis is the most common type of meningitis, the initial symptoms are similar to those of bacterial meningitis, and clinical features cannot reliably differentiate viral from bacterial meningitis.^(1; 2) The incidence of bacterial meningitis has decreased significantly in Canada following widespread pneumococcal, *Haemophilus influenza* type b (Hib) and meningococcal vaccination. A high index of suspicion for meningitis must be maintained in infants and children presenting with any signs of sepsis, particularly if there is no focus of infection nor altered mental status.⁽³⁾

CAUSES

Bacteria

- Group B *Streptococcus*, *Escherichia coli* (*E. coli*) and other gram-negative bacilli⁽⁴⁾
- *Listeria monocytogenes*⁽⁴⁾
- *Streptococcus pneumoniae* (*S. pneumoniae*)⁽⁴⁾
- *Neisseria meningitidis* (*N. meningitidis*) causing meningococcal meningitis⁽⁴⁾
- *Haemophilus influenza* type B⁽⁴⁾
- *Mycobacterium tuberculosis*⁽⁵⁾

Viruses⁽⁴⁾

- Non-polio enteroviruses (coxsackievirus A, coxsackievirus B, echoviruses)⁽⁴⁾
- Mumps virus
- Herpes virus
- Measles virus
- Influenza virus
- Arboviruses, e.g. West Nile virus
- Lymphocytic choriomeningitis virus

Note: Human herpes simplex virus (HSV) infection in neonates can result in devastating outcomes, including significant morbidity and potential mortality.⁽⁶⁾ Disseminated HSV infection can mimic bacterial sepsis, and clinicians need to consider possible neonatal HSV infection in unwell infants less than 6 weeks of age.

Fungi⁽⁴⁾

- *Candida*
- *Cryptococcus*
- *Histoplasma*
- *Blastomyces*
- *Coccidioides*

TRANSMISSION, INCUBATION PERIOD, COMMUNICABILITY

H. influenzae, *N. meningitidis* and *S. pneumoniae* are the most common causative bacteria beyond the newborn period and are all respiratory pathogens. For more information, see Table 1.

TABLE 1

Transmission, Incubation Period and Communicability of Bacterial Causes of Meningitis

CAUSATIVE BACTERIA	TRANSMISSION	INCUBATION PERIOD	COMMUNICABILITY
<i>H. influenzae</i>	Spread person-to-person by: <ul style="list-style-type: none"> - Direct contact or - Respiratory droplets produced by coughing and sneezing.⁽⁷⁾ 	Unknown; may be as little as a few days ⁽⁷⁾	<ul style="list-style-type: none"> - As long as organisms are present - Non-communicable within 24 to 48 hours after appropriate antibiotic treatment.⁽⁸⁾
<i>N. meningitidis</i>	Spread person-to-person by: <ul style="list-style-type: none"> - Exchanging respiratory and throat secretions during close or lengthy contact - Exchanging saliva (the most common transmission method) - Transmission is highest among household contacts^(9; 10). 	2 to 10 days ⁽¹¹⁾	<ul style="list-style-type: none"> - 7 days before onset of symptoms until organism is no longer present in secretions from nose and mouth - Non-communicable within 24 hours after appropriate antibiotic treatment⁽¹²⁾ - The communicability of <i>N. meningitidis</i> is generally limited.⁽¹¹⁾
<i>S. pneumoniae</i>	Spread person- to- person through: <ul style="list-style-type: none"> - respiratory droplets⁽¹³⁾ 	1 to 3 days ⁽¹³⁾	Unknown; presumably as long as the organism appears in respiratory secretions ⁽¹³⁾

ASSESSMENT

Medication review: Review current medications, including over-the-counter, complementary and alternative medicines, as well as any chemical or substance intake that may impact management.

Allergy history: Screen for medication, latex, environmental or other allergies and determine approximately when and what type of reaction occurred.

RISK FACTORS

Bacterial

- Age; infants are at increased risk for bacterial meningitis compared to people in other age groups⁽¹⁴⁾

- Community setting⁽¹⁴⁾
- Certain medical conditions⁽¹⁴⁾
- Cochlear implants⁽¹⁵⁾
- Penetrating head trauma⁽¹⁵⁾
- Working with meningitis-causing pathogens⁽¹⁴⁾
- Travel to areas where meningitis is common⁽¹⁴⁾
- Incomplete vaccinations⁽¹⁶⁾

Viral

- Neonates are at increased risk for severe systemic disease, particularly those with herpes simplex virus (HSV).⁽²⁾
- Children younger than 5 years old⁽¹⁾
- Individuals with weakened immune systems caused by disease, medications (such as chemotherapy) and recent organ or bone marrow transplantations are at greater risk for severe illness.⁽¹⁾

HISTORY OF PRESENT ILLNESS

Review risk factors and collect history of present illness.

- Recent infection, especially respiratory or otic infection⁽¹⁵⁾
- Recent use of antibiotics⁽¹⁵⁾
- Immunization history⁽¹⁵⁾

Infants

Infants often present with non-specific signs and symptoms:

- Fever
- Poor feeding
- Lethargy
- Vomiting
- Rash
- Irritability^(2; 15; 16)
- Seizures^(2; 15)

Older Children

Older children are more likely to have more specific signs and symptoms related to meningitis:

- Fever^(2; 15)
- Headache^(2; 16)
- Photophobia^(2; 16)
- Nausea^(2; 16)
- Vomiting^(2; 16)
- Confusion⁽¹⁵⁾
- Lethargy⁽¹⁵⁾
- Irritability⁽¹⁵⁾
- Neck stiffness^(2; 16)
- Impaired consciousness^(2; 16)
- Seizures⁽²⁾

Social

Known contact with someone with meningitis⁽³⁾

PHYSICAL FINDINGS

Perform a full physical examination (including a full head, neck and neurological examination) using the IPPA approach.

- Elevated temperature or hypothermia in infants⁽¹⁵⁾
- Respiratory distress⁽¹⁵⁾

- Bulging fontanelle⁽¹⁵⁾
- Focal neurologic signs, including:
 - Photophobia^(2; 15)
 - Nuchal rigidity (more likely in older children)^(2; 15)
 - Positive Brudzinski's sign in children greater than 12 months of age (spontaneous hip flexion with passive neck flexion)^(2; 15)
 - Positive Kernig's sign in children greater than 12 months of age (pain with passive knee extension and hip flexion)^(2; 15)
- Petechial rash with or without purpura⁽¹⁵⁾
- The constellation of hypertension, bradycardia and respiratory depression is a late sign of increased intracranial pressure.⁽¹⁵⁾
- Shock⁽¹⁵⁾ (for more information, see *FNIHB Pediatric and Adolescent Care – Chapter 20 – General Emergencies and Major Trauma – Shock*).

Note: Head circumference should be measured in children younger than 18 months old.⁽¹⁵⁾

DIFFERENTIAL DIAGNOSIS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

- Bacteremia⁽¹⁷⁾
- Bacterial endocarditis with embolism⁽¹⁵⁾
- Brain tumor⁽¹⁵⁾
- Central nervous system abscess⁽¹⁵⁾
- Central nervous system tuberculosis⁽¹⁷⁾
- Cerebral vasculitis⁽¹⁷⁾
- Sepsis⁽¹⁷⁾
- Subdural empyema⁽¹⁵⁾

COMPLICATIONS⁽¹⁸⁾

- Impaired mental status
- Cerebral edema and increased intracranial pressure
- Seizures
- Focal deficits, e.g. hearing loss, cranial nerve palsies, hemiparesis or quadriparesis
- Ataxia

- Cerebrovascular abnormalities
- Neuropsychologic impairment, developmental disability
- Subdural effusion or empyema
- Hydrocephalus
- Hypothalamic dysfunction
- Septic shock
- Death

DIAGNOSTIC TESTS

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

Diagnostic test selection is based on client history, risk factors, physical examination findings and test availability. Consult accepting facility to determine if laboratory tests are required pre-transfer.

Laboratory

Testing should be carried out as per provincial/territorial policies and procedures. The tests below are for consideration.

Blood Cultures

- Obtain 2 blood samples for culture⁽¹⁵⁾ before initiating antibiotic therapy for suspected cases of meningitis. This increases the likelihood of isolating the organism.
- Adequate blood volume is very important in detecting bacteremia. The optimal blood volume for blood cultures varies by age.

For additional information regarding blood culture collection, including required volumes, see provincial/territorial laboratory guidelines.

Additional Lab Investigations

- CBC⁽¹⁵⁾
- Electrolytes⁽¹⁵⁾
- Creatinine⁽¹⁵⁾
- Blood glucose⁽¹⁵⁾
- Urea⁽¹⁵⁾
- Throat swab for culture and sensitivity (C+S) as clinically indicated⁽¹⁶⁾
- Urine C+S as clinically indicated⁽¹⁶⁾

X-ray

Chest X-ray as clinically indicated⁽¹⁶⁾

MANAGEMENT

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

GOALS OF TREATMENT

- Treat the infection
- Prevent/treat complications
- Prevent spread of infection

NON-PHARMACOLOGICAL INTERVENTIONS

Interventions

- Nothing by mouth (NPO), depending on child's level of consciousness
- Reassess neurological status frequently and document Glasgow Coma Scale (GCS)
- Assess fontanelles
- Maintain accurate intake and output
- Administer oxygen as required

Client Education⁽¹⁹⁾

Provide the following to the child and parent(s)/caregiver(s):

- Emotional support; the sudden nature of the illness makes this extremely important
- Reassurance that the natural onset of meningitis is sudden

Additional information to provide parent(s)/caregiver(s) is available from: www.aboutkidshealth.ca/En/HealthAZ/ConditionsandDiseases/InfectiousDiseases/Pages/Meningitis.aspx

PHARMACOLOGICAL INTERVENTIONS

In addition to consulting a physician/nurse practitioner, review the drug monograph, the FNIHB Nursing Station Formulary or provincial/territorial formulary before initiating treatment.

Fluid Management in Meningitis

- Establish peripheral intravenous (IV) access.
- If unable to establish a peripheral IV, an intraosseous (IO) needle should be used⁽³⁾ as per provincial/territorial policies/procedures.
- Careful management of fluid and electrolyte balance is important in the treatment of meningitis.⁽²⁰⁾
- For children who are not in shock or not hypovolemic, fluids should be restricted in consultation with a physician/nurse practitioner.⁽²⁰⁾

Note: Development of generalized edema is a major risk factor for serious adverse outcomes in meningitis.

Immediate Fluid Resuscitation for Child with Signs of Dehydration or Shock at Presentation

- For children with evidence of dehydration or shock, consult with a physician/nurse practitioner immediately.
- Treat shock with rapid IV/IO 0.9% sodium chloride bolus of 20 mL/kg infused over 10-20 minutes.
- Repeat bolus as needed up to 4 times in patients without improvement and **NO** signs of volume overload.^(21; 22)
- Manage fluid on an ongoing basis following fluid resuscitation in consultation with the physician/nurse practitioner.

For hourly maintenance fluid requirements, see *Table 2 in Appendix, Section A* of this guideline.

Fluid Management for Child with Signs of Raised Intracranial Pressure (ICP) or Generalized Edema

- Consult with a physician/nurse practitioner immediately for children with signs of raised ICP, which include:
 - GCS score less than 9 or a drop in GCS score of 3 or more
 - Relative bradycardia and hypertension

- Focal neurological signs
- Abnormal posture or posturing
- Unequal, dilated or poorly responsive pupils
- Papilledema
- Bulging fontanelle
- Unresponsiveness to painful stimuli

Antibiotic Therapy

- Start antibiotic immediately if bacterial meningitis is suspected. Timely empirical antibiotic therapy is critical to treatment success because the prognosis of meningitis depends on treating infection before severe disease ensues.⁽¹⁶⁾
- While the client waits to be medically evacuated, as per guidance from the accepting facility or physician/nurse practitioner, empirical antibiotics may need to be initiated.
- Empirical treatments may be comprised of 2 to 3 antibiotics:
 - CefTRIAXone IV (avoid in clients who are 3 months of age or younger to avoid risk of hyperbilirubinemia) or cefoTAXime IV combined with vancomycin IV
 - Ampicillin IV may be added to cover *Listeria* for the immunocompromised client at risk.⁽¹⁶⁾

Empiric Antibacterial Regimen for Neonates (Infants <1 month)(28)

Ampicillin plus cefoTAXime (See dosages below)

Neonates \leq 7 days Ampicillin

- For infants weighing less than or 2 kg: ampicillin 100 mg/kg/day IV divided q 12h
- For infants weighing more than 2 kg: ampicillin 150 mg/kg/day IV divided q 8h
- If group B streptococcus (GBS) is suspected: ampicillin 200 mg/kg/day IV divided q 8h

PLUS

cefotaxime (Claforan)

- For infants weighing less than 2 kg: cefotaxime 100 mg/kg/day IV divided q 12h
- For infants weighing 2 kg or more: cefotaxime 100-150 mg/kg/day IV divided q 8h

Neonates > 7 days

Ampicillin

- For infants weighing less than 1.2 kg: ampicillin 100 mg/kg/day IV divided q 12h
- For infants weighing between 1.2 - 2 kg: ampicillin 150 mg/kg/day IV divided q 8h
- For infants weighing more than 2 kg: ampicillin 200 mg/kg/day IV divided q 6h
- If group B streptococcus (GBS) is suspected: ampicillin 300 mg-400 mg/kg/day IV divided q 4-6 h

PLUS

cefotaxime (Claforan)

- For infants weighing between 1.2-2 kg: cefotaxime 150 mg/kg/day IV divided q 8h
- For infants weighing more than 2 kg: cefotaxime 150-200 mg/kg/day IV divided q 6-8h

Empiric Antibacterial Regimen for Children Four Weeks and Older(16)

Vancomycin plus cefotaxime (for children 3 months of age or less)

or

Vancomycin plus ceftriaxone (for children more than 3 months of age)(See dosages below)

- vancomycin 60 mg/kg/day IV divided q 6 h; maximum dose 4g/day

PLUS EITHER:

- cefotaxime 300 mg/kg/day IV q 6 h; maximum dose 8 g/day to 12 g/day

or

- ceftriaxone 100 mg/kg IV at diagnosis; repeat the dose of 100 mg/kg IV at 12 h and then 100 mg/kg/day IV divided q12h; maximum dose 4 g/day. (Intramuscular route can be used if intravenous route is not immediately available)

If *Listeria monocytogenes* is suspected because of an underlying immunodeficiency, IV ampicillin should be added.

Ampicillin

- ampicillin 300 mg/kg/day IV divided q 4 h to 6 h; maximum dose 12 g/day

For clients who cannot be given either vancomycin or a third-generation cephalosporin due to a contraindication (e.g., allergies), expert infectious diseases opinion should be sought. In all clients, treatment should continue until susceptibility results return.

Anti-inflammatory Therapy

Dexamethasone is indicated if there are no contraindications to steroid use when bacterial meningitis is suspected.

Infants and Children Greater than 2 Months of Age:

Dexamethasone

- Dexamethasone IV q6h (calculate 0.6 mg/kg in 24 hours divided q6h; maximum 20 mg/dose)
- Administer first dose of dexamethasone immediately before or within 30 minutes after the first dose of antibiotic⁽¹⁶⁾

Analgesic/Antipyretic

Note: Since neonates and infants (less than 3 months of age) are less able to mount a febrile response, when they do become febrile, it is more likely to indicate a major illness. Consult physician/nurse practitioner particularly for children less than 3 months of age.

Acetaminophen⁽²³⁾

- Acetaminophen 10 to 15 mg/kg/dose PO q4-6h PRN
- Maximum from all sources: acetaminophen 75 mg/kg/day or 4,000 mg/day, whichever is less.

Ibuprofen⁽²³⁾

Infants <6 months

- Limited data available in infants

For 6 Months to 12 Years of Age

- Ibuprofen 5 to 10 mg/kg/dose PO q6-8h PRN
- Maximum 400 mg/dose*

For Greater than 12 Years of Age

- Ibuprofen 200 to 400 mg PO q4-6h PRN*

* Maximum from all sources for all ages:

- Ibuprofen 40 mg/kg in 24 hours or 1200 mg in 24 hours, whichever is less. Under physician/nurse practitioner supervision, daily doses ≤2,400 mg may be used.

MONITORING AND FOLLOW-UP

Consult physician/nurse practitioner when practice is outside legislated scope and without authorized delegation.

MONITORING

- If administering an agent with risk of anaphylaxis, monitor the client closely for 30 minutes.
- Monitor vital signs, including oxygen saturation, as indicated by client's condition
- Monitor level of consciousness, focal neurologic signs as indicated by client's condition
- Monitor intake and output

FOLLOW-UP

Referral

- Arrange for urgent medical evacuation

Reporting

Meningitis is reportable. Follow provincial/territorial policies and procedures for notifiable diseases. For more information, see *Communicable Diseases Provincial/Territorial Resources for Meningitis* in *Appendix, Section B* of this guideline.

APPENDIX

SECTION A: SUPPLEMENTAL CLINICAL MANAGEMENT INFORMATION

TABLE 2

Hourly Maintenance Fluid Requirements

CALCULATION
<ul style="list-style-type: none"> - 4 mL/kg/hour for first 10 kg of body weight - Add 2 mL/kg/hour for the next 10 kg of body weight (over the initial 10 kg of body weight) - Add 1 mL/kg/hour for each kilogram over 20 kg of body weight
Maximum of 100 mL/hour or 2,400 mL in 24 hours needed for maintenance
EXAMPLES
<ul style="list-style-type: none"> - For 10 kg child: $10 \text{ kg} \times 4 \text{ mL/kg/hour} = 40 \text{ mL/hour}$ - For 15 kg child: $(10 \text{ kg} \times 4 \text{ mL/kg/hour}) + (5 \text{ kg} \times 2 \text{ mL/kg/hour}) = 50 \text{ mL/hour}$ - For 25 kg child: $(10 \times 4 \text{ mL/kg/hour}) + (10 \text{ kg} \times 2 \text{ mL/kg/hour}) + (5 \text{ kg} \times 1 \text{ mL/kg/hour}) = 65 \text{ mL/hour}$

Prevention and Control

Vaccines are the cornerstone of prevention and control of bacterial meningitis.⁽²⁴⁾ For more information, see the latest *Canadian Immunization Guide*, available from: <http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php>

Meningitis Caused by *Haemophilus influenzae*

- In Canada, the *Haemophilus influenzae* type B (Hib) vaccine has been provided in public programs in all provinces and territories since 1998.
- The type of vaccine and the immunization schedule vary by province; however, the vaccine is usually given at 2, 4, 6 and 18 months of age, along with the DPTP vaccine.
- Due to routine immunization, meningitis caused by *H. influenzae* is now very rare and primarily occurs in unimmunized or partially immunized children, or in individuals who are immunocompromised. Disease due to other serogroups (e.g., non-B) has been increasing in all parts of Canada, but particularly in Northern populations.⁽¹⁶⁾

Meningitis Caused by *Neisseria meningitidis* (Meningococcal Meningitis)

- The incidence of meningococcal disease in children and adults has decreased significantly since the introduction of routine meningococcal serogroup C immunization programs.⁽¹⁶⁾
- The impact of the introduction of the quadrivalent conjugated A, C, Y and W meningococcal vaccine for adolescents is not yet known.⁽¹⁶⁾

Meningitis Caused by *Streptococcus pneumoniae* (Pneumococcal Meningitis)

- The incidence of pneumococcal meningitis has also decreased significantly in all age groups since the introduction of routine vaccination against *S pneumoniae*.⁽¹⁶⁾
- Publicly funded infant immunization programs against *S pneumoniae* were available in all provinces and territories by 2005.
- As of 2011, the heptavalent conjugate vaccine (PCV7) has been replaced by a 13-valent pneumococcal conjugate vaccine (PCV13) in all provinces and territories.⁽¹⁶⁾

Chemoprophylaxis for Household Contacts Meningitis Caused by *Haemophilus influenzae*⁽²⁵⁾

- Chemoprophylaxis is not required for household contacts of cases of invasive Hib infection when the contacts have completed a vaccine series against Hib. When contacts less than 48 months of age are incompletely immunized, consult with local public health officials.

Meningococcal Meningitis

- Offer chemoprophylaxis to all persons having close contact with a case of IMD from 7 days before onset of symptoms in the case to 24 hours after onset of effective treatment, regardless of their immunization status.⁽²⁶⁾
- Close contacts of individuals with meningococcal infections have an increased risk of developing invasive meningococcal disease (IMD); this risk is greatest for household contacts.
- The following individuals (regardless of immunization status) should receive chemoprophylaxis and, if the meningococcal serogroup identified in the case of IMD is vaccine preventable, should also be considered for immunoprophylaxis:
 - Household contacts of a case of IMD
 - Persons who share sleeping arrangements with a case of IMD
 - Persons who have direct nose or mouth contamination with oral or nasal secretions of a case of IMD (e.g., kissing on the mouth, shared cigarettes, sharing bottles)
 - Children and staff in contact with a case of IMD in child care or nursery school facilities
- The following individuals should receive chemoprophylaxis only, immunoprophylaxis is not necessary:
 - Health care workers who have had intensive unprotected contact (without wearing a mask) with infected patients (i.e., intubating, resuscitating or closely examining the oropharynx).

- Airline passengers sitting immediately on either side of the case (but not across the aisle) when the total time spent aboard the aircraft was at least 8 hours.
- Close contacts of a case of IMD due to serogroups not present in meningococcal vaccines, or when the serogroup in the index case has not been determined.
- Previously vaccinated close contacts who do not meet the criteria for re-vaccination as outline above.

Chemoprophylaxis

Offer chemoprophylaxis for contacts of cases with meningococcal meningitis using ONE of the following options:⁽²⁷⁾

Rifampin

Infants less than 1 month old:

- Rifampin PO BID for 2 days (calculate 5 mg/kg/dose)

Infants and children 1 month old and greater:

- Rifampin PO BID for 2 days (calculate 10 mg/kg/dose; maximum 600 mg/dose)

Adults

- Rifampin 600 mg PO BID for 2 days

or

- Ciprofloxacin 500 mg PO for one dose

CefTRIAXone

Adolescents less than 12 years of age:

- CefTRIAXone 125 mg IM for one dose

Adolescents and adults greater than/equal to 12 years of age:

- CefTRIAXone 250 mg IM for one dose

Pregnant women:

Note: CefTRIAXone is the agent of choice in pregnant women. Neither rifampin nor ciprofloxacin are recommended in pregnancy.

Pneumococcal Meningitis

Chemoprophylaxis is not required post-exposure.

SECTION B: SUPPLEMENTAL RESOURCES

Provincial/Territorial Guidelines

Alberta

Alberta Health and Wellness
Public Health Notifiable Disease Management Guidelines: Meningococcal Disease, Invasive (IMD). Available from: <https://open.alberta.ca/publications/meningococcal-disease-invasive-imd>

British Columbia

BC Centre for Disease Control
Communicable Disease Control Manual: Meningococcal Disease. Available from: <http://www.bccdc.ca/health-professionals/clinical-resources/communicable-disease-control-manual/communicable-disease-control>

Manitoba

Public Health and Primary Health Care
Communicable Disease Management Protocols: Invasive Meningococcal Disease (*Neisseria meningitidis*). Available from: <http://www.gov.mb.ca/health/publichealth/cdc/protocol/mid.pdf>

Newfoundland and Labrador

Department of Health and Community Services
Newfoundland and Labrador Disease Control Manual: Section 3 Diseases Preventable by Routine Vaccination. Available from: <http://www.health.gov.nl.ca/health/publichealth/cdc/control.html>

Northwest Territories

Northwest Territories Health and Social Services
Communicable Disease Manual. Available from: <http://www.hss.gov.nt.ca> by selecting HSS Professionals (staff only) and entering authorized username and password.

Nova Scotia

Nova Scotia Department of Health and Wellness
Nova Scotia Communicable Diseases Manual: Diseases and Conditions: Meningococcal Disease – Invasive (IMD). Available from: <http://novascotia.ca/dhw/cdpc/cdc/documents/Meningococcal-Disease-Invasive.pdf>

Yukon

Yukon Health and Social Services
Yukon Communicable Disease Control: Meningococcal Disease. Available from: http://www.hss.gov.yk.ca/pdf/ycdc_meningococcal.pdf

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