Tuberculosis

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Tuberculosis

Principles

The principles for the management of tuberculosis are:

1. Follow-up all persons with infectious tuberculosis.
2. Initiate contact tracing of all persons (contacts) exposed to infectious cases and provide appropriate education, evaluation and management for TB.
3. Identify infected persons and those high risk for developing TB and provide appropriate education, evaluation and treatment.
4. All cases of pulmonary and extrapulmonary TB will be reported to the office of the Chief Medical Officer of Health and added to the surveillance database.
5. Complete all Health Canada reports of new tuberculosis cases and treatment outcome forms and forward to the office of the Chief Medical Officer of Health.

General Guidelines for Tuberculosis

1. Information

1.1. Case definition:

Confirmed Case of tuberculosis:
Laboratory confirmation of infection:

- Demonstration on culture (from a specimen taken from the patient) of *Mycobacterium tuberculosis* complex (i.e. *M. tuberculosis, M. bovis* [excluding BCG strain], or *M. africanum*).

Clinical Case of Tuberculosis

- Clinical findings compatible with active tuberculosis in the absence of bacteriologic proof. Examples of clinical findings compatible with active tuberculosis are chest radiographic changes compatible with active tuberculosis including idiopathic pleurisy with effusion, active extrapulmonary tuberculosis (meningeal, bone, kidney, peripheral lymph nodes etc.), and pathologic or post-mortem evidence of active tuberculosis.

1.2. Causative agent:

The mycobacteria are rod-shaped bacteria which do not stain readily but once stained, resist decolorization by acid alcohol and are therefore called acid-fast bacilli.

1.3. Symptoms:

Symptoms may include cough, pleuritic pain, fever, night sweats, unexplained weight loss. Primary tuberculosis is often a sub-clinical or mild self-limited illness.

1.4. Incubation:

Exposure to mycobacterium tuberculosis may result in tuberculosis infection (as measured by tuberculin skin test) but not tuberculosis disease. Tuberculosis disease may occur months to years after infection or may never occur.

1.5. Source:

Human. Rarely animal.

1.6. Transmission:

Tuberculosis is an airborne disease transmitted via droplet spread.

1.7. Communicability:

The communicability of tuberculosis depends on the infectiousness of the index case, the degree of contact (i.e. in terms of the likelihood of the contact having breathed the same air as the index case when he or she was infectious) and the susceptibility of those contacts. It is important to consider the potential infectiousness of the index case. Factors that indicate a high degree of infectivity include:

- Sputum is smear positive.
- Index case has laryngeal TB.
- Index case has an abnormal Chest X-Ray (cavities).
- Index case has a productive cough.

1.8 Treatment:

Mycobacterium tuberculosis is slow to produce disease and equally slow to respond to drug therapy. A combination of anti-TB drugs with full compliance for a minimum of six months is required to achieve 100% cure rate. See Canadian TB Standards document.

1.9. Prophylaxis:

Tuberculosis occurs as a result of infection that most commonly takes place months to years before the onset of clinically apparent disease. The tuberculin test is used to identify those who are carrying the tubercular bacillus before clinical disease is evident. There is now well documented evidence that isoniazid (INH), prescribed as a chemoprophylactic agent, is effective in preventing the future development of tuberculosis (see Appendix for more information).

2. Procedure

2.1. Roles and Responsibilities

2.1.1. Medical Officer of Health:

a. Assess case.

At time of referral of the index case, the MOH makes an assessment of the likelihood of the client having the disease by reviewing clinical, laboratory and radiological information with the attending physician. Depending on assessment and the potential degree of infectivity, MOH initiates the contact tracing process by Public Health Services (PHS) staff.

- The main priority in infectious cases is to ensure that no new individuals are exposed to the index case until the index case is rendered non-infectious by appropriate chemotherapy.
- For program purposes tuberculosis is classified into **Active** or **Suspect Active**.
- **Suspect Active** is a 'holding' category and clients should be reclassified as **Active** or **Presumed Inactive** within 6 months of first being labelled **Suspect Active**.
- It is **presumed Inactive** when the lesion appears to be inactive but there is no documentation of previous active disease. The site of the lesion determines further clinical classification.

Tuberculosis becomes **Inactive** when client has completed an adequate course of treatment and follow-up, and investigation has confirmed the inactive status.

b. Coordinate investigation:

- Co-ordinate communication among all staff involved in management of a case and contacts after initial testing of high-risk contacts has occurred.
- Supervise ongoing contact tracing to ensure that the protocol for contact tracing is completed.
- Ensure that all necessary clinical and epidemiological information on clients and contacts is completed.
- Initiate and review any screening for tuberculosis infection that occurs within the District.
- Act as a resource to other health professionals about tuberculosis control principles and provide advice about national treatment standards for individual cases.

2.1.2. Investigator:

Contact tracing and examination is undertaken at the earliest opportunity for all clients with active or suspected active respiratory tuberculosis, whether or not tubercle bacilli are found in the sputum.

a. Initiate Contact Tracing.

Upon notification from the Medical Officer of Health, the Investigator will attempt to identify those at risk of being infected by the index case and determine if there are any other sources of infection in the community.

- If there is any doubt about the time the index case could have been infectious and hence how far back to trace contacts, then this should be discussed with the Medical Officer of Health.
- All Accredited Acute Care facilities should have tuberculosis control policies in place. The investigator should contact the responsible person in the hospital to ensure that contact tracing is co-ordinated.
- In situations where facilities do not have tuberculosis control policies, the investigator should provide the responsible professional in the institution with direction in contact tracing of clients and staff.
- In situations where the index patient has been in a hospital, contact tracing among staff and clients who are hospitalized will be the responsibility of the hospital infection control practitioner.
- All clients who are determined to be contacts and have been discharged from hospital should be referred to PHS for follow-up in the community. The hospital should supply PHS with name, gender, age, address, phone number and name of family physician. It should be noted when the contact occurred and type of contact (e.g. same room, same Unit) and length of exposure.

b. Visit client's home, and if necessary, place of work.

c. Take a detailed history.

Take a detailed history from the index case identifying possible contacts. By definition household contacts are at high risk but there may be a large number of non-household contacts.

d. List all possible contacts and start a Tuberculosis Survey Sheet.

- Contacts are all those who may have been infected by a case of active TB. Contacts may be classified as "close," "casual" or "community" contacts.
- **Close household contacts** are those that live in the same household as the infectious case. Household contacts are considered by definition to share breathing space on a daily basis with the source case.
- **Close non-household contacts** are those that have regular, prolonged contact with the source case and share breathing space daily but do not live in the same household. These include regular sexual partners and close friends.
- **Casual contacts** are others who spend time regularly but less frequently with the infectious case. These may include classmates, colleagues at work or members of a club or team.
- **Community contacts** are those who have infrequent, occasional contact with the infectious case. These may include, for example, those who attend the same school or workplace, but are not in regular contact with the case.

Close contacts are the group most likely infected. These persons are therefore the priority for investigation. If there is no evidence of infection in this group it is unlikely that further investigation of the casual and community contacts will be necessary. If, however evidence of infection is found in close contacts, then extension of the contact tracing protocol to casual and community contacts becomes important. This enables best deployment of resources on those at greatest risk.

All contacts must be advised that they should see a physician if they develop symptoms suggestive of tuberculosis (e.g. cough, pleuritic pain, fever, night sweats, unexplained weight loss, etc.).

All contacts that are approached should be provided with information about tuberculosis, the way it is transmitted and the types of treatment and chemoprophylaxis available.

e. Begin examination, starting with the high-risk contacts.
Interview all close contacts for history of previous TB infection or diseases and tuberculin tests status. Follow the contacts according to flow charts. Meet regularly to discuss contact follow up with the MOH.

Examination of the contacts should follow the procedure indicated in the Flow Charts (see Appendix 6). Based on the flow charts, one of two procedures will need to be performed on the close contacts.

Tuberculin Testing:
Read in 48 - 72 hours. Record the amount of induration in mm. People with documented evidence of a previous positive tuberculin reaction and those with a documented history of tuberculosis may be exempted from tuberculin skin testing. Previous BCG is not a contraindication to tuberculin testing (see Appendix 7 for more information on Tuberculin Testing).

Chest X-Ray
A chest X-Ray should be performed on:

- All contacts exempted from tuberculin testing.
- Contacts with a tuberculin reaction greater than 4 mm.
- All contacts with symptoms of tuberculosis even if their tuberculin test is negative.
- In the case of a pregnant woman chest X-rays should be delayed until after the delivery. It is important that the diagnosis of tuberculosis be considered should the woman become ill during the pregnancy.

The ordering of Chest X-rays is the responsibility of the client's personal physician. The investigator should ensure that the physician is aware of the recommendation for a Chest X-Ray and of the Contact Tracing protocol required by PHS. The **Request for Chest X-Ray** may be sent to the physician if required (see Request form in Appendix 5).

The following information will help the physician in making a decision about the medical management of the contact and the investigator should provide the physician with any of the following found during contact tracing:
- The degree of infectiousness of the index case.
- The degree of closeness of the contact.
- The history of a BCG given.
- The results of any past and recent TST's.
- The past history of any treatment for tuberculosis.
- The results of the most recent Chest X Ray performed (if available).

The Medical Officer of Health should be informed of any situations where the physician does not follow the contact tracing protocol.

f. Discuss with Medical Officer of Health.
After initial investigation of high-risk contacts, discuss the completed Tuberculosis Survey Sheet with the Medical Officer of Health.

g. Decide extent of contact tracing and management of individual contacts.
The Medical Officer of Health will discuss with the investigator the results of the contact tracing to date in order to decide how far to extend the contact tracing and to provide advice on the management of individual contacts as per the flow charts.

Recommendations from the Medical Officer of Health will take into account the following:

- A person known to be tuberculin skin test positive is unlikely to develop disease from this exposure. However, they must be assessed for latent tuberculosis infection and for active tuberculosis.

Tuberculin reactivity tends to be decreased in the following:

- Poor injection technique.
- Immune suppression due to advanced age, corticosteroids, cancer therapy agents, or HIV infection, especially if advanced (CD4 count< 500).
- Malnutrition, particularly when there has been recent weight loss.
- Severe illness, which can include tuberculosis.
- Viral illness or vaccination with live virus vaccine such as MMR vaccine. If vaccination or viral illness has occurred recently, tuberculin testing should be delayed by at least 1 month.

Cross-reaction with many mycobacteria, other than tuberculosis, (including BCG) may produce a false positive tuberculin reaction. The general rule is that the larger the reaction size, the greater chance that infection has been caused by Mycobacterium tuberculosis.

h. Continue updating Tuberculosis Survey Sheet.
Continue to update the Tuberculosis Survey Sheet with Chest X-Ray results, PPD reports and chemoprophylaxis initiation as repeated testing of contacts occurs and keep the Medical Officer of Health informed of the results as each testing cycle is completed (see flowcharts in Appendix 6).

i. Record keeping.
At the completion of contact tracing, the investigator will complete the Tuberculosis Contact Screening Worksheet and discuss it with the Medical Officer of Health. Records of past TB history, past BCG history, past PPD history, of cases and contacts must be kept to allow optimum management should contacts investigated in the past become contacts of new index cases.

2.1.3. Physician:

a. Report new TB cases to PHS.
The physician is required to notify PHS of all new cases of Tuberculosis Disease. This should be done by phone within 48 hours of the diagnosis being made in order to ensure prompt attention to potential contacts and so that timely recommendations can be made by the Medical Officer of Health about any isolation precautions.

b. Treatment.
The attending physician determines the therapy prescribed for index cases and contacts diagnosed with active tuberculosis.

- It is important that PHS be made aware of situations where compliance with chemotherapy is likely to be a problem in order that consideration to **Directly Observed Therapy (DOT)** can be given
- Public Health Services is often asked to provide suggestions regarding treatment in which case national treatment standards are recommended. The current standard for treatment is "Canadian Tuberculosis Standards, 5th edition"

c. Evaluate all referred contacts.
Evaluate all contacts referred for medical opinion and decide on the need for preventive therapy with INH. The physician is also responsible for monitoring patients on chemoprophylaxis and informing the PHS of the degree of compliance with the medication.

d. Notify PHS about the outcome of the medical evaluation.
Notify PHS about the outcome of the medical evaluation of those contacts referred for medical assessment.

3. Protocol for Follow-up of Individuals Placed Under Surveillance for Inactive TB

3.1. Background

All immigrant applicants, refugees and certain visitors to Canada are required to undergo an immigration medical examination (IME).

Individuals newly arrived in Canada are referred for medical surveillance for TB by Citizenship and Immigration Canada (CIC) because of a previous history of TB, or an abnormal chest radiograph suggestive of inactive TB.

Persons identified as requiring medical surveillance are required to sign a Medical Surveillance Undertaking Form (IMM 0535). Upon entry to Canada, they are required to report to Public Health authorities within 30 days.

All entrants subject to medical surveillance will, in addition to the Medical Surveillance Undertaking Form (IMM 0535), receive a handout which instructs the entrant must telephone the public health authority in their area of residence in Canada within 30 days of entry. The handouts include a list of provincial/territorial public health authority contact telephone numbers for each condition.

The activities of CIC's Medical Surveillance Unit (MSU) includes checking the legibility/completeness of the information on the IMM 0535. Every attempt will be made to capture an in-Canada contact address/telephone number of entrants placed under medical surveillance

The MSU will then provide the IMM 0535 to the public health authority of the entrant's declared destination in Canada.

3.2. Follow up by Public Health

1. Upon receiving a Medical Surveillance Form (IMM 0535), a Public Health nurse initiates follow-up, checking form for complete address and "S" code.

   (a) Address – if incomplete or not present contact CIC officer. If address unobtainable, contact: Ottawa Medical Surveillance (613) 946-0941 (Health Canada)

   (b) S code (Box 8) – 2.02 needs to be checked off on form. This indicates that surveillance to be done is for inactive tuberculosis. The other codes listed are for the following diseases:
   2.01 active tuberculosis
   2.04 adequately treated positive syphilis serology

   If code not checked off or clearly indicated contact CIC Officer, for clarification or Ottawa Medical Surveillance.

   (c) Box 10 – Serial No. indicates status of immigration applicant: F = student; U = work permit; W = immigrant; C = visitor.

2. Once address and code is complete and confirmed 2.02 for inactive TB surveillance, contact client either by phone or home visit. If client's English language fluency is inadequate a home visit may be appropriate, particularly if a family member can interpret.

3. Complete the "Immigration Follow-up Inactive Tuberculosis" form. Indicate demographic data, ethnicity and date of entry to Canada, health history related to tuberculosis, date and place of last chest x-ray, and present health status.

4. Advise client to arrange a medical evaluation, including a chest x-ray. Client must be assessed by a family physician from which client will be receiving ongoing medical care.

5. Prior to client's medical assessment, the Public Health Nurse contacts client's family physician, informing the physician that the client is under medical surveillance undertaking for inactive tuberculosis and requires a chest x-ray and physical examination. Please refer to 'Guidelines for the Investigation of Individuals Placed Under Surveillance for Tuberculosis Post Landing in Canada" *(CCDR October 2001, Vol. 27, Number 19)*. Requisition form for chest x-ray should indicate, "chest x-ray is necessary for medical purposes". Advise physician to fax or mail chest x-ray results to Public Health Services.

6. Once the "Immigration Follow-up Inactive TB" form is completed and physician notified, forward form to CDC coordinator who will contact Ottawa for the immigration medical chest x-ray film.

7. Once both chest x-ray reports are available, the MOH will arrange for the Hospital's Radiology Dept. to compare films. Recommendations for client follow-up will be made to the family physician.

Immigration Follow-up Inactive Tuberculosis

Date of Investigation: _____

Name: _____

Address: _____

_____

Phone: _____

DOB: _____

Family Physician: _____

Date of entry to Canada: _____

Country of Origin: _____

Ethnicity: _____

Date of last TB Infection: _____

Date of History Treatment: _____

_____

Date and Place of Last Chest X-Ray: _____

_____

_____

Other Pertinent History: _____

_____

_____

Date of Last Follow-up with Physician: _____

Comments: _____

_____

_____

MOH Comments: _____

_____

_____

Investigator: _____

Appendix 1: Drug Monitoring Policy

1. Overview

Public Health Services will cover the cost of the drugs necessary for treatment of tuberculosis. The cost of chemoprophylaxis is also covered. Only those drugs that are recommended as part of national treatment standards will be covered. Any exceptions to this must be discussed with the Medical Officer of Health.

PHS should not dispense medication. PHS should develop a mechanism for dispensing anti-tuberculosis medication using the local retail or hospital pharmacies. PHS should supply the anti-tuberculosis medication to the pharmacy or hospital as necessary and arrange to cover the cost of dispensing the medication.

PHS has two responsibilities.

- To assist the attending physician in adequately treating cases to ensure that they become and remain non-infectious.
- To assist the attending physician to monitor and improve the compliance of contacts who have been prescribed INH chemoprophylaxis in order that their chance of becoming infectious in the future can be significantly reduced.

1.1 The Index Case

1.1.1. Management

The index case's attending physician should be contacted in order to discuss monitoring of compliance.

It is important that the duration of each prescription for anti-tuberculosis therapy not be too long in order that problems with compliance can be recognised early. A monthly prescription is the maximum length that should be recommended.

The attending physician should be provided with the package of information for physicians and clients. If the physician has any concerns that compliance is poor or unknown it is important that the investigator be informed as soon as possible.

In situations where medication has to be discontinued either because of side effects or because of problems with drug resistance the investigator must be informed as soon as possible.

1.1.2. Non-compliant index cases.

If an index case is referred to PHS by a physician as being non-compliant in picking up or taking the medication, the Investigator will communicate with the client to:

- Ensure that the case is educated regarding the risks of inadequate treatment of tuberculosis;
- Ensure that the patient is aware of the benefits from treatment.
- Determine what factors are decreasing the chance of compliance.

If the case's compliance cannot be achieved after the above, the Medical Officer of Health must be informed.

1.1.3. Medication Change

If a physician changes the index case's medication, he or she must notify the Medical Officer of Health.

1.2. The Contact on Chemoprophylaxis

Physicians are primarily responsible for monitoring the compliance of contacts for which they prescribe Isoniazid chemoprophylaxis.

1.2.1. Send documents to physician.

The Investigator should send the **appropriate TB Chemoprophylaxis Sheet**, a copy of **Chemoprophylaxis Information**, a copy of the **INH Follow Up Record** and a copy of the **Patient Isoniazid Information** to the physicians of contacts for whom Isoniazid is being considered. If the physician has any concerns that compliance is poor or unknown and cannot improve this or if the contact has to stop chemoprophylaxis because of side effects, it is important that the MOH be informed as soon as possible.

1.2.2. Non-compliant contacts.

Non-compliant contacts should be managed in the same manner as non-compliant index cases as outlined above in 1.1.2.
The Medical Officer of Health should be informed of contacts that cannot achieve compliance.

1.3. Direct Observed Therapy

Poor compliance with prescribed antituberculous therapy is the most common reason for treatment failure. Directly observed therapy (DOT), i.e. watching the patient swallow each dose of medication, is an effective way to monitor adherence with therapy. TB drug regimens utilizing DOT have been shown to significantly reduce the rate of drug resistance and the rate of relapse when compared with self-administered therapy. DOT may be given daily, or 2 or 3 times a week. Intermittent regimens are clinically effective and have similar toxicity to daily regimens, however, all intermittent regimens must be DOT. If self-administered therapy is the only option for drug delivery, the drugs must be taken daily.

DOT with a suitable regimen should ideally prevent the emergence of drug resistance. Since resistance rates as low as 2.1% have been reported in program DOT evaluations, this rate is the recommended program standard. These objectives are best met with compliance rates that should reach at least 80% of the total prescribed doses. Therefore, treatment should continue until a *minimum* of 76 doses have been taken for a 95-dose regimen, even if the regimen extends beyond the expected six months.

For patients in whom this is not possible or in whom compliance is difficult to predict, the most effective method of drug delivery is DOT rather than self-administered therapy. DOT allows the total number of doses to be reduced and importantly, allows patient defaulting to be quickly identified. DOT should be considered for patients with the following features:

- Intermittent dosing regimens
- Suspected or known drug-resistant organisms
- Documented relapse disease
- Injection drug-users (IDU)/homeless patients
- HIV/AIDS
- Suspected inadequate compliance
- Psychopathology

Appendix 2: Treatment of Latent Tuberculosis Infection

Chemoprophylaxis or preventive treatment refers to the treatment after tuberculosis infection has occurred but before tuberculosis disease is present. Treatment of latent TB infection (LTBI) is started only after TB disease has been excluded.

Treatment of LTBI is recommended for persons at greatest risk of TB disease (see table below). INH is recommended in a dose of 10 – 50 mg/kg daily for children, up to a maximum of 300 mg per day. For adults, the dose is 300 mg daily. The twice-weekly dose is 20-40 mg/kg, to a maximum of 900 mg/dose in children and 900 mg/dose in adults. The addition of vitamin B6 is indicated when there is poor nutrition, alcoholism, pregnancy, diabetes, uremia, or other disorders that might predispose to neuropathy. It is also recommended in the neonatal period.

Indications*for Treatment of LTBI in High-Risk Groups

Tuberculin reaction size	Indication
≥ 5 mm	HIV infection Recent contact of infectious TB Presence of lung scar (compatible with old healed TB but not previously treated)
≥ 10 mm	Converters (within 2 years) Immunosuppression: • Organ transplantation • Chronic renal failure • Prolonged corticosteroid or immune suppressive drug therapy • Hematologic malignancies – leukemia, lymphoma • Silicosis • Diabetes mellitus • < 90% of ideal body weight

* Consider treatment of LTBI in other persons, particularly those ≤ 35 years of age, who have a tuberculin reaction size ≥ 10 mm and are from one of the following groups: foreign-born from TB endemic countries, Aboriginals, health care workers, and residents in communal care.

Appendix 3: Additional Disease Information

1. Introduction

Pulmonary disease remains the most common and the most important form of tuberculosis. Tuberculosis is spread from person to person only when an individual with pulmonary tuberculosis coughs and discharges *Mycobacterium tuberculosis* into the air. Pulmonary tuberculosis should be considered in any patient who has been coughing for more than 4 weeks and, usually, for less than one year. Such a symptom whether with haemoptysis, fever, weight loss, night sweats or not should be sufficient indication for a chest x-ray and sputum culture for tuberculosis.

Apart from cough, tuberculosis should be suspected in any patient who has an otherwise unexplained fever or loss of weight, drenching sweats at night, or coughs up blood.

TB should be considered in all patients with the following: HIV infection, diabetes, malignant disease, silicosis, those on long term corticosteroid or immunosuppressive therapy.

A high index of suspicion for tuberculosis should be maintained in the elderly. The disease is more common and more atypical in the elderly.

Having considered a diagnosis of tuberculosis, the next step is to assess the tuberculin status and arrange for a chest x-ray and mycobacterial studies of appropriate specimens.

2. Primary tuberculosis

The initial infection with *Mycobacterium tuberculosis* causes a small pulmonary parenchyma infiltrate with enlargement of the regional lymph node. In the immune competent host, the infection is usually asymptomatic (90%-95%). The lesion heals with fibrosis and may calcify late, producing the Ghon lesion. In children, the intensity of the lymph node enlargement may cause symptoms due to compression of an adjacent bronchus. A dry cough may be associated with mild systemic symptoms. A chest X-ray at this stage would demonstrate the “primary complex” of enlarged hilar or paratrachael nodes and parenchyma infiltrate usually in the lower lobe. Of all symptomatic primaries approximately 30% show lymph node enlargement alone. The sputum or gastric wash in such patients is only positive for Mycobacterium tuberculosis in about 35% of cases. Diagnosis is therefore often based on a positive tuberculin skin test and the radiological appearance alone.

Bronchial compression may cause lobar consolidation and atelectasis with

secondary bacterial infection. Allergic manifestations such as erythema nodosum and phlyctenular conjunctivitis can be associated with primary TB, but also with fungal infection, streptococcal infection, sarcoidosis and some drug administration.

Primary progressive tuberculosis occurs in 5% of those infected. Extension of the infection occurs in the site of primary invasion and at sites of distant spread including lung apices, renal cortex, vascular bone and lymph nodes. Although only 5% of primary infections are immediately symptomatic, the organism remains viable in the inactive fibrotic lesion and in 10-15%, reactivation occurs years or decades later.

3. Adult pulmonary tuberculosis (post primary) or reactivation tuberculosis

The result of late reactivation of organisms harboured since the primary infection is so-called adult or post primary tuberculosis. It rarely occurs in childhood but is occasionally seen in adolescence. The usual site of the lesion is in the apical or posterior segment of an upper lobe or the superior segment of a lower lobe. It is there that the highest tissue oxygen (O2) levels are found (130 mm Hg). The optimum PO2 for mycobacterial growth is 140 mm Hg. Although the usual site is in the upper lobes, up to 30% present atypically in other parts of the lung. Such atypical presentations are common in elderly and in immunocompromised patients. Clinical symptoms may be absent (20%) or may range from mild to severe. Cough may be dry or associated with sputum production depending on the size and nature of the lesion. Chest pain is uncommon but may be pleuritic in nature. Systemic symptoms include fever, chills, night sweats, weight loss and general malaise.

The earliest lesion is a parenchymal infiltrate. Gradual extension occurs with central necrosis and cavitation. Healing results in fibrotic scarring and loss of volume. Spontaneous healing may occur. X-ray changes are slow. Clinical signs and symptoms depend on extent and duration of involvement.

Cavity formation is usually associated with large numbers of organisms and prolonged infectivity. Haemoptysis may occur and is usually due to bronchial mucosal ulceration. Rarely the pulmonary vasculature is eroded causing a massive and sometimes fatal bleed. Pleural disease, due to rupture of subpleural caseous lesion, produces an exudative effusion with predominant lymphocytosis, protein greater than 30 g/litre, an elevated LDH, and pH less than 7.2. *Mycobacterium tuberculosis* is cultured from the pleural fluid in less than 50% of cases. Pleural biopsy is a more useful diagnostic tool and yields a greater percentage of positive cultures and characteristic histology.

4. Extra-pulmonary tuberculosis

Tuberculosis may present in sites other than the lung. Non-pulmonary tuberculosis presents in lymph nodes, the genito-urinary system and less commonly in other sites such as central nervous system, gastrointestinal tract, bone, pericardium and soft tissue. Approximately 40% of tuberculosis cases in Canada are extrapulmonary.

4.1. Renal tuberculosis.

The origin of renal tuberculosis is via haematogenous dissemination from the primary lung infection. The *Mycobacterium tuberculosis* is believed to produce a small focus of infection within the glomerulus. If the infection is not contained, rupture into the tubule is postulated, carrying the organism to the medullary portion of the kidney. Proliferation, extension and eventual necrosis of the papilla is recognized radiologically as blunting of the calyces. Subsequent downward spread may involve the infundibulum, the pelvis, the ureter, bladder, urethra and male genital organs. As in the pulmonary lesion, healing is associated with fibrosis and scarring. Close observation during the treatment period is important to detect obstructive lesions before hydronephrosis and loss of function occurs. About 10% of patients with pulmonary tuberculosis have asymptomatic renal tuberculosis which may be indicated by the finding of "sterile" pyuria. Follow up is necessary to detect obstructive lesions that remain one of the few indications for surgery in renal tuberculosis.

4.2. Lymph node tuberculosis.

Involvement of lymph nodes is most often seen in the cervical region but is second in incidence to hilar and paratracheal involvement associated with primary infection. It was once believed that scrofula (bull neck) was due to ingestion of unpasteurized milk contaminated with bovine strain of tubercle bacilli. However, it is now recognized that the human strain of *Mycobacterium tuberculosis* reaches cervical nodes via the haematogenous route. Surgery may be necessary to establish the diagnosis of tuberculous lymph node disease or to drain abscesses. It is essential to culture any specimens obtained at surgery to distinguish disease caused by *Mycobacterium tuberculosis* from similar disease caused by other mycobacteria such as *Mycobacterium avium-intracellulare.* Tuberculosis lymph node disease is treated with the usual antituberculosis chemotherapy. It is not unusual for the lymph node enlargement to increase when treatment is commenced and sometimes again after several months of treatment. Such a development does not necessarily indicate that the treatment is not effective.

4.3. Bone and joint tuberculosis.

Haematogenous spread may seed *Mycobacterium tuberculosis* in vascular bone, growing ends of long bones in children and vertebral bodies in adults. Vertebral lesions account for about one-third of all osseous tuberculosis and are most common in the lumbar region. Extension through the intervertebral disc space and into the next vertebral body occurs. Extension posterior may create and intracanalicular abscess with subsequent compression of the spinal cord (Pott's Disease). Surgery is indicated to relieve progressive neurological sequelae of cord compression. In the early phases of healing, avoidance of weight-bearing and lifting is important because of the risk of compression fractures. Extension laterally into the paravertebral soft tissue spaces occurs and tuberculosis abscesses have been seen to track for long distances in any direction.

The knees and hips are the most common joints affected by tuberculosis. Often extension through the articular cartilage into the joint is the cause of the first signs and symptoms of osseous tuberculosis. The fibrosis of healing often leads to fusion. Treatment consists of anti tuberculosis drugs and surgery is seldom necessary.

Tuberculous joint disease should be considered in any case of monoarthritis.

4.4. Tuberculosis meningitis

CNS tuberculosis accounts for 0.5% of all active cases annually. It originates in a cerebral focus which ruptures with predominant lymphocytosis (although the initial response may show a predominance of polymorphs) elevation of protein and low CSF sugar relative to the blood sugar. Z-N smears are positive in less than 25% and cultures in less than 50%. The diagnosis is often delayed due to the slow onset of symptoms of headache, lethargy and varied neurological complaints. The mortality is still 25% and increases with increasing delay in diagnosis. Neurological sequelae are common and may affect 40-50% of cases when diagnosis and treatment are delayed. The most frequent neurological complications are single cranial neuropathies, hemiplegia, hydrocephaly and mental retardation. These disorders are thought to be caused by tuberculous arteritis involving the intracranial vessels resulting in thrombosis and focal tissue infarction.

Treatment must include INH, Rifampin, Pyrazinamide. INH and Pyrazinamide cross the blood/brain barrier without impediment. 20% of Rifampin crosses under normal circumstances. During the inflammatory response higher levels can be achieved.

Corticosteroid drugs are usually added for 1-3 months to diminish the intense inflammatory response and frequency of late neurological sequelae due to vasculitis. (But steroid therapy may decrease the penetration of the blood brain barrier by Rifampin.)

4.5. Gastrointestinal tuberculosis.

Gastrointestinal tuberculosis accounts for less than 1% of active disease. Peritonitis requires tissue for diagnosis because of the low yield of ascitic fluid culture. Intestinal tissue should also be submitted for culture as Crohn's disease produces lesions in the bowel wall which are indistinguishable pathologically from tuberculosis.

4.6. Female genital tuberculosis.

Female genital tuberculosis accounts for 1.5% of active tuberculosis. It is believed that the vascular Fallopian tubes are the site of haematogenous seeding in the adult. Spread to ovary and endometrium occurs. Patients commonly present with infertility. Menstrual irregularities are common.

4.7. Disseminated (or miliary) tuberculosis.

The term *miliary* comes from millet seed and refers to the small, diffuse infiltrates seen radiologically in lungs but occurring in all body tissues to which *Mycobacterium tuberculosis* is disseminated when massive haematogenous dissemination occurs. Disseminated tuberculosis accounts for 2% to 3% of cases.

The bacilli enter the bloodstream during the initial stages of primary infection, before the host's immune system has fully responded, or later during reactivation of disease in a respiratory or non-respiratory site (late generalized TB). The disease may be manifest as a military pattern on chest radiograph, as a bone marrow aspirate/biopsy or blood culture positive for *M. tuberculosis*, or with widespread tuberculosis granulomas at histopathologic analysis.

When the prevalence of tuberculosis is high, disseminated TB occurs most commonly in childhood; when prevalence of TB is low, it is mainly a disease of adults, including the elderly, and those infected with HIV.

Appendix 4: Patient Information

INH (ISONIAZID) TREATMENT

USE

INH is one of the drugs your doctor has prescribed for treatment of your tuberculosis (TB).

INSTRUCTIONS

- If you have any allergies or are taking any other drugs you should mention this to your doctor before taking this drug.
- It is very important to follow the directions on the label about the number of pills to be taken and at what time or times of day they should be taken.
- The drugs should be taken regularly as prescribed. Skipping pills can lead to delays in your recovery.

SIDE EFFECTS

This drug may have some side effects. These can include:

- Excessive tiredness.
- Yellowish colour to the skin.
- Pain in joints.
- Numbness or pins and needles in hands and or feet.

Should one of these or any other unusual symptoms occur you should contact your doctor immediately.

Your doctor should order tests before starting medication. Your doctor will be seeing you regularly while you are under treatment for TB and will do blood tests during this period. It is very important to keep all scheduled appointments.

Failure to take your medication as prescribed may lead to the medication no longer working.

INH (ISONIAZID) PROPHYLAXIS

USE

INH is a drug commonly used for people who have been in contact with tuberculosis (TB) to prevent them from developing TB.

INSTRUCTIONS

- If you have any allergies or are taking any other drugs, mention this to your doctor before taking this drug.
- It is very important to follow the directions on the label about the number of pills to be taken and at what time or times of day they should be taken.
- The drugs should be taken regularly as prescribed.

SIDE EFFECTS

This drug may have some side effects. These can include:

- Excessive tiredness.
- Yellowish colour to the skin.
- Pain in joints.
- Numbness or pins and needles in hands and or feet.

Should one of these or any other unusual symptoms occur you should contact your doctor immediately.

Your doctor should order tests before starting medication. Your doctor will be seeing you regularly while you are under treatment with INH. Your doctor should do blood tests during this period. It is very important to keep all scheduled appointments.

Failure to take your medication as prescribed may lead to the medication no longer working.

ETHAMBUTOL TREATMENT

USE

Ethambutol is one of the drugs your doctor has prescribed for treatment of your tuberculosis (TB).

INSTRUCTIONS

- If you have any allergies or are taking any other drugs, you should mention this to your doctor before taking this drug.
- It is very important to follow the directions on the label as to the number of pills to be taken and at what time or times of day they should be taken.
- The drugs should be taken regularly as prescribed. Skipping pills can lead to delays in your recovery.

SIDE EFFECTS

This drug may have some side effects. These may include:

- Vision problems.
- Stomach upset.
- Rash.
- Dizziness.
- Headache.

Should one of these or any other unusual symptoms occur you should contact your doctor immediately. Your doctor should order tests before starting medication. Your doctor will be seeing you regularly while you are under treatment for TB and may do some blood tests during this period. It is very important to keep all scheduled appointments.

Failure to take your medication as prescribed may lead to the medication no longer working.

RIFAMPIN

USE

Rifampin is one of the drugs your doctor has prescribed for treatment of your tuberculosis (TB).

INSTRUCTIONS

- If you have any allergies or are taking other drugs you should mention this to your doctor before taking this drug.
- It is very important to follow the directions on the label as to the number of pills to be taken and at what time or times of day they should be taken.
- The drugs should be taken regularly as prescribed. Skipping pills can lead to delays in your recovery.

SIDE EFFECTS

This drug may have some side effects. These can include:

- Turning urine, stool, sweat and tears red. As a result, contact lenses should not be worn while on this drug.
- Birth control pills may not be effective, so another birth control method should be used while on this medication.
- Stomach upset.
- Headache.
- Drowsiness.
- Tiredness.
- Itching.
- Vision problems.
- Muscle weakness.

Should one of these or any other unusual symptoms occur you should contact your doctor immediately. Your doctor should order tests before starting medication. Your doctor will be seeing you regularly while you are under treatment for TB and should do blood tests during this period. It is very important to keep all scheduled appointments.

Failure to take your medication as prescribed may lead to the medication no longer working.

PYRAZINAMIDE (PZA)

USE

Pyrazinamide (PZA) is one of the drugs your doctor has prescribed for treatment of your tuberculosis (TB).

INSTRUCTIONS

- If you have any allergies or are taking any other drugs, you should mention this to your doctor before taking this drug.
- It is very important to follow the directions on the label as to the number of pills to be taken and at what time or times of day they should be taken.
- The drugs should be taken regularly as prescribed. Skipping pills can lead to delays in your recovery.

SIDE EFFECTS

This drug may have some side effects. These can include:

- Stomach problems.
- Yellow skin.
- Tiredness.
- Skin rash.

Should one of these or any other unusual symptoms occur you should contact your doctor immediately. Your doctor should order tests before starting medication. Your doctor will be seeing you regularly while you are under treatment for TB and should do some blood tests during this period. It is very important to keep all scheduled appointments.

Failure to take your medication as prescribed may lead to the medication no longer working.

Tuberculin Skin Test

The Test

The test can show if you have been exposed to TB at anytime in the past. A small amount of tuberculin is injected just under the skin of the lower part of the arm. For a short time after the needle is given, a small raised area under the skin may appear at the site of injection.

Who Should Not Have the Test

In some cases the tuberculin test may not be useful or should not be done. If any of the following apply to you please tell the nurse or doctor before the test is done:

- Severe blistering in reaction to a previous TB test.
- Active TB or history of treatment for TB infection or disease.
- Extensive burns or eczema.
- Major viral infections or immunization.

The Result

Your arm will need to be looked at by a nurse or doctor 48-72 hours after the test to see if there is a positive or negative reaction. The result of the test may vary from no reaction at all to a red raised area with some surrounding redness. Occasionally someone very sensitive to the tuberculin may have some blistering at the site of the test. This will usually clear up without treatment.

Sometimes after the test is read and after reviewing your medical history it may be recommended that a chest x-ray be done.

Appendix 5: Request for Chest X-ray

Dear Dr:

Re:

Address:

Date Of Birth:

5TU PPD Date: Result:

Past History:

Your patient named above has been a contact of tuberculosis and was screened as part of the contact tracing. He/she requires a Chest X-Ray as part of the screening protocol developed by Public Health Services. Please send a copy of the Chest X-Ray report to your local Public Health Services office to help us evaluate the need for further contact tracing.

The Chest X-Ray Report may help in determining whether the patient is a candidate for consideration of Isoniazid (INH) prophylaxis. If the result of the contact tracing indicates that your patient might benefit from INH chemoprophylaxis, the patient will be referred back to you. We will also send you current Public Health Guidelines about INH chemoprophylaxis to help you in making your decision about further patient management.

If your patient has or develops respiratory symptoms, he or she should be evaluated for any evidence of tuberculosis disease.

If you would like further information about our contact tracing protocol or about INH chemoprophylaxis, please do not hesitate to call.

Public Health Nurse:

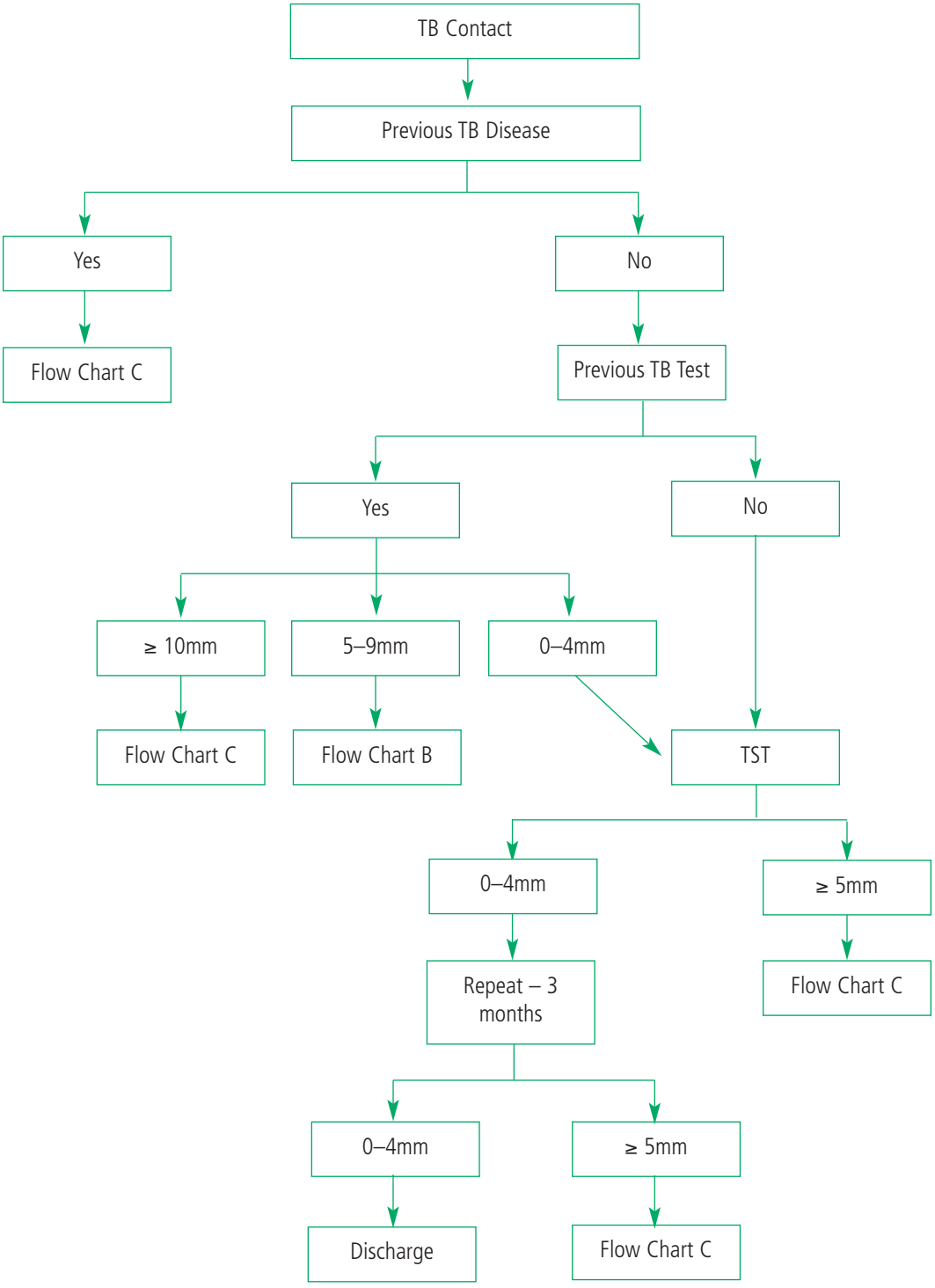
Phone:

Date:

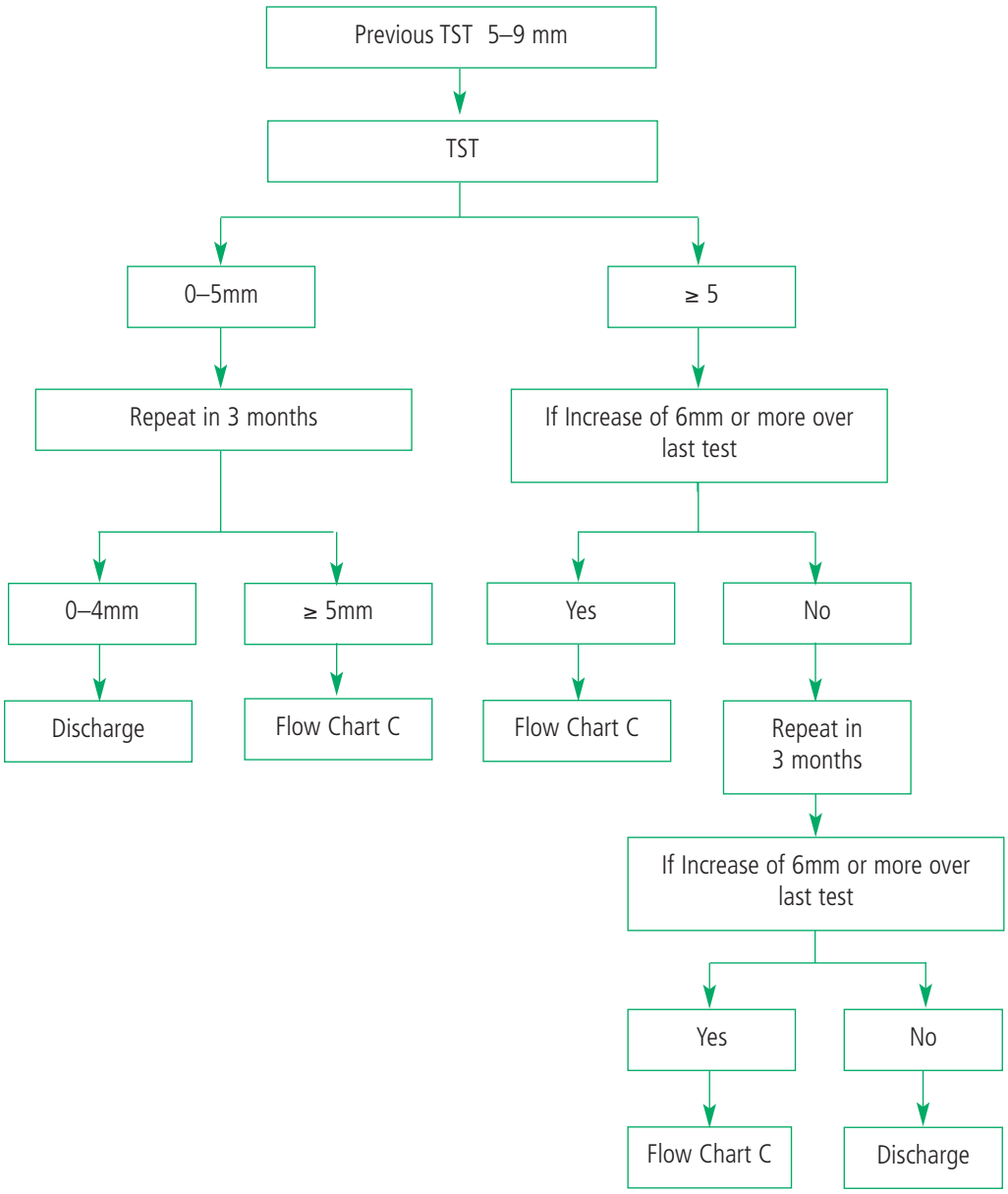
Sample Letter

Appendix 6: Flow Charts

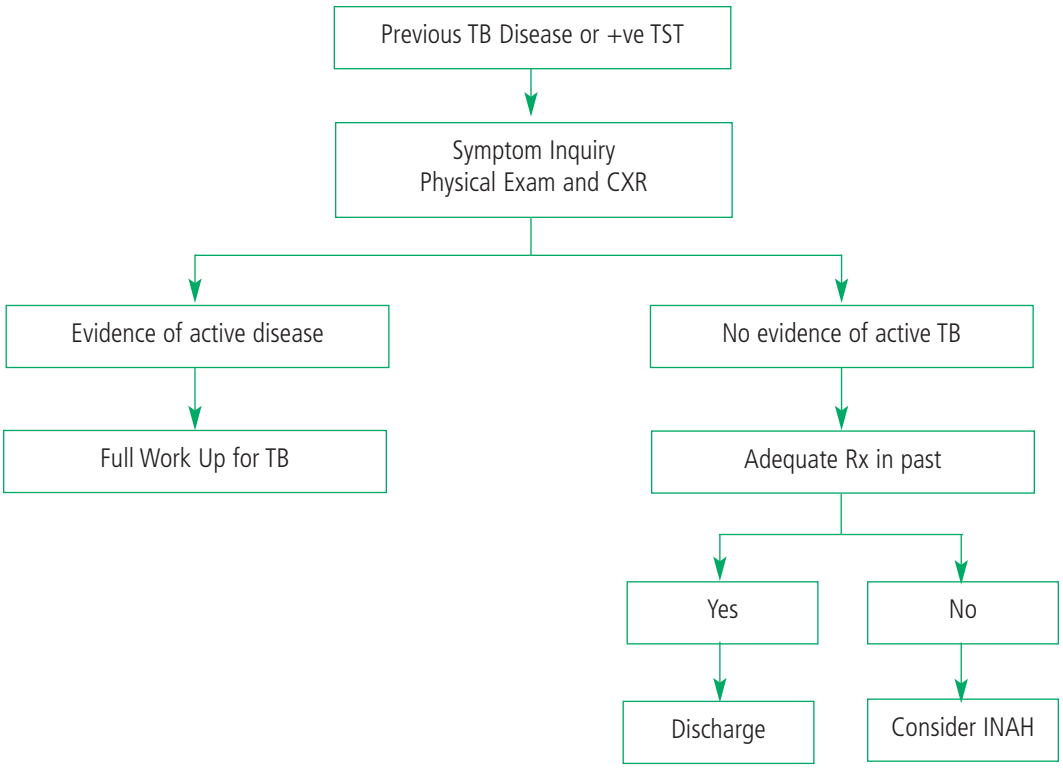
Flow Chart A



Flow Chart B


Previous TST 5–9 mm
TST
0–5mm
≥ 5
Repeat in 3 months
If Increase of 6mm or more over last test
0–4mm
≥ 5mm
Yes
No
Discharge
Flow Chart C
Flow Chart C
Repeat in 3 months
If Increase of 6mm or more over last test
Yes
No
Flow Chart C
Discharge

Flow Chart C


Previous TB Disease or +ve TST
Symptom Inquiry
Physical Exam and CXR
Evidence of active disease
No evidence of active TB
Full Work Up for TB
Adequate Rx in past
Yes
No
Discharge
Consider INAH

Appendix 7: Guidelines for Tuberculin Testing in Long Term Care

Developed by: Partners for Infection Control
Approved by: Nova Scotia Department of Health

Tuberculin Skin Testing (Mantoux) in Long Term Care

Introduction

Long term care facilities (nursing homes and homes for special care residents) should ensure that all new resident's tuberculin skin test status is known and record maintained.

The following guidelines are designed to assist Long Term Care facilities (LTC) to ensure necessary screening and follow up for the residents. Although screening for tuberculosis (TB) is the responsibility of the LTC, identified cases of active TB should be referred to Public Health Services for follow up purposes.

Knowing the tuberculin skin test status of the staff is also important but this is a pre-employment and occupational health issue that should be addressed by the organization/employer.

Organism

Tuberculosis is a mycobacterial infection caused by *Mycobacterium tuberculosis*, an acid -fast bacillus (AFB).

Transmission

Most commonly, the tubercle bacillus is transmitted from one person to another in minute droplets of moisture that become increasingly reduced by evaporation, creating "droplet nuclei". Droplet nuclei are created by forceful expiratory efforts such as coughing, sneezing, singing and playing wind instruments. Certain procedures such as bronchoscopy, autopsy and even irrigation of tuberculous abscesses may also produce infectious aerosols.

Tubercle bacilli that are lodged on fomites (linen, furniture, books, floors) do not constitute a significant source of infection; most die quickly through the action of drying, heat or sunlight.

Several factors combine to permit transmission of infection and its sequelae in the exposed person. Transmission involves the contagiousness of the source case, the nature of the contact, the environment and susceptibility of those exposed.

The rate of transmission can be measured by the percentage of close contacts (household and non-household) whose tuberculin responses are converted from negative to significant reactive, or in whom active tuberculosis disease develops.

Primary Infection

More than 90% of patients are entirely asymptomatic at the time of primary infection and can be identified only through conversion of the tuberculin skin test.

The tuberculin skin test is positive in about 90% of patients with tuberculosis. Some reports have recorded anergy in up to 20% or more of patients in the earlier acute phase, prior to treatment. This is more likely to occur in the very ill, those with miliary disease or advanced pulmonary disease or those who are malnourished.

With appropriate treatment the prognosis for pulmonary tuberculosis is excellent.

Tuberculin Skin Testing(Mantoux)

The tuberculin skin test involves the injection into the skin of a small amount of purified protein derived from tubercle bacilli. In a person who has previously developed cell-mediated immunity to these tuberculin antigens, this will elicit a delayed cell-mediated reaction (delayed hypersensitivity type) within 48 hours. The reaction will cause localized swelling, manifested as induration of skin at the injection site.

In persons who are exposed to an active case of tuberculosis, the delayed cell-mediated reaction to tuberculin will not be manifested immediately. It will develop between 2 and 10 weeks after the acquisition of infection.

Indications

Why do a tuberculin skin test?

The tuberculin skin test (Mantoux) is one of the screening methods used to:

- document a base line tuberculin test on all new residents
- investigate persons in whom active tuberculosis is suspected
- identify persons who have been infected with *Mycobacterium tuberculosis*.
- find out the extent of transmission in contacts.

Who needs a tuberculin skin test in LTC?

- All new admissions to LTC (except for those contraindicated).
- Persons with signs and/or symptoms of current tuberculosis disease.
- Recent contacts of known tuberculosis cases.
- All health care workers who are in contact with residents (refer to Guidelines For Tuberculin Skin (Mantoux) Testing In The Community, Nova Scotia Department of Health, Oct. 1999).

Contraindication

- Residents with severe blistering tuberculin reaction in the past;
- Residents with documented active TB or documented treatment (active or passive) in the past;
- Residents with extensive burns or eczema;
- Residents with vaccination with a live vaccine in the past month.

What is a Tuberculin Skin Test (Mantoux)?
An intradermal injection of a small amount (0.1 mL) of purified protein derived from tubercle bacilli.

- **Equipment:**
  - 1cc tuberculin syringe
  - 3/8in. 26 or 27 gauge needle
  - alcohol swab
  - 5 TU Tuberculin purified protein derivative (Mantoux)
  - gauze sponge
- **Preparation:**
  - provide privacy to ensure confidentiality
  - obtain TB history (previous TB disease and treatment, exposure, previous skin test result) and assess for current symptoms
  - explain procedure to client and obtain informed consent
  - plan to read 48 to 72 hours after administration
  - provide good lighting
  - wash hands
  - wipe rubber cap of PPD vial with alcohol swab and allow to dry
  - draw up PPD into syringe
  - draw up a bit more than 0.1 mL to allow for losses
  - tap syringe to break up air bubbles and squirt out a drop of antigen until there is exactly 0.1 mL PPD in syringe
  - draw up PPD immediately before injection
  - choose a test site that is free of blood vessels, lesions, hair or edema on the volar or lexor (palm side) surface of the forearm, 10 centimeters (4 inches) below the elbow crease; the standard site is the left forearm.

How do you administer the test?

Procedure:
- support arm on firm surface
- wipe injection site with alcohol swab and allow to dry completely
- stretch arm at injection site taut before inserting needle
- hold syringe almost parallel to the skin with needle bevel up
- insert needle into the superficial layers of skin until bevel is fully inserted and the tip is visible under the skin
- release tautness and stabilize syringe
- inject antigen slowly; resistance will be felt as tuberculin enters between the layers of skin and forms a bleb 5 to 10 mm in diameter

If little resistance is felt and there is no bleb or the appearance of a shallow diffused bulge, the needle has been placed too deeply. This may result in induration which will be difficult to measure and impossible to interpret.

Or

If a substantial portion of the dose leaks out, the needle has not been placed deeply enough and the test result will not be reliable.

Then

Repeat test at least 5 cm (2 inches) from original site or in the other arm.
- withdraw needle and without recapping dispose of the syringe and needle in a puncture resistant container according to your agency's policy
- wipe drop of blood that may appear at injection site with a gauze sponge
- record administration date on client record including date, antigen, lot #, dose, route and site.

How to Read the Tuberculin Skin Test
- Read test 48-72 hours after administration
- The presence or absence of induration is measured. If blistering present, document it.
- The site should be inspected from a side view against the light, as well as by direct light and by palpation.
- If induration is present only the transverse diameter is measured i.e., measure across the arm parallel to the watch band.
- Use a flexible ruler to measure size of induration in mm.
- Redness without induration is probably allergic reaction and does not indicate tuberculous infection.

What do the Results Mean?

The interpretation of the test depends on the reason for testing.
- 0 - 4 mm of induration is negative
- 5 - 9 mm of induration is positive if:
  - contact of an active case
  - abnormal chest x-ray with fibronodular disease
  - HIV positive
- 10 mm or more of induration is positive.

Two Step

Policy:

All new residents to LTC should have a two-step tuberculin test unless contraindicated on assessment.

A 2-step procedure should be used for all new residents to long term care. A 2-step initial testing procedure allows the clinician to distinguish between a booster response and conversions caused by new infection. This procedure is only done once on an individual to determine baseline status.

2-Step Procedure:

- The initial test is administered as per normal practice.
- If the size of the reaction is significant, no further testing is required and the person is referred for a tuberculosis assessment.
- If the reaction is not significant, a second test should be repeated 7-21 days later.
- Record first and second results on client record. Second result serves as the baseline.
- Measurement must be recorded in millimeters - e.g., 0-mm.

Product Information

- 5 TU dosage available in l mL (10 test) vial.
- Store between 2° to 8°C. Ensure cold chain has not been broken.
- Avoid exposure to light. Store in the box.
- Date vial when opened.
- Once opened, discard after one month.

Conclusion:

TB continues to be a health risk to the resident's of long term care facilities. Screening of residents at the time of admission helps to identify active cases of TB and to document base line tuberculin skin testing status of the residents. This in turn will help prevent and control TB in the LTC more effectively.

The tuberculin skin testing (mantoux) is an excellent screening tool to assess resident's exposure to TB.

References:
The Canadian Lung Association, *Canadian Tuberculosis Standards*, Fourth edition,1996.
Health Canada, *Guidelines For Preventing The Transmission Of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings*, April 1996
Health Canada, *Infection Control Guidelines For Occupational Health in Health Care Facilities*, 1987.
Pasteur Merieux Connaught, *Tuberculin Skin Test Guidelines*,1998.
Tolomeo Ornella, et al., "Recommendations For TB Control", *Canadian Nursing Home*, Vol. 6, Number 2, May - June 1995.

Appendix 8: Glossary of Terms

Active Disease: The presence of current active tuberculosis most often on the basis of positive bacteriologic confirmation but in approximately 15% of cases on the basis of appropriate clinical and radiologic presentation with a response to therapy.

Anergy: The failure of a subject to respond to skin test antigens because of immune deficiency that is due, for example, to infection with the human immunodeficiency virus or to immunosupperssive therapy.

Booster Phenomenon: The presence of initial negative PPD response followed by a positive response when the test is repeated, usually within one to four weeks. The phenomenon often occurs many years after infection, most notably in the elderly. The initial negative response is based on the subject's initial failure to "recall" immunologically prior infection. To avoid inadvertent labelling of a positive response as due to a PPD conversion, initial two-stage skin testing, especially when serial skin testing is planned, is usually recommended.

Conversion: The presence of a significant 10 mm or greater PPD response following an insignificant response in the previous two years.

Culture Positive: The presence of positive mycobacteriologic culture of body secretions, most notably sputum, for the presence of M. tuberculosis.

Index Case: The initial active case from which the process of contact investigation begins.

Induration: The skin test response to an antigen, which is read 48 to 72 hours after injection. It is measured in millimeters and refers to elevated response to the antigen, excluding any associated erythema.

Infection: Infection of a host by the M.tuberculosis organism, which lies dormant in an asymptomatic state. There is a subsequent approximate 10% risk of life time future reactivation and development of active disease in an immune competent host.

Infectious: The condition whereby the subject can transmit infection to others by virtue of the production of infectious aerosols.