Tuberculosis Transmission and Infection Control

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Elderly patient with chronic cough and weight loss

HPI
- 74 year-old, African American female
- ER with complaints of shortness of breath and progressive weakness
- Increasing SOB over the last 4 days
- Associated with fevers, chills, cough, with purulent sputum
- Family noted history of cough and weight loss over last several months
Chest X-Ray

Admission

8 months prior to admission
CT Scan: Extensive air-space disease left apical, post cavitary
Hospital Course

• Admitted to floor – Community Acquired Pneumonia
• Treated: ampicillin-sulbactam / azithromycin
• Respiratory failure → Intubated 24 hours later
• Blood and routine sputum cultures negative.
• Bronchial alveolar lavage (BAL)

5/5 respiratory specimens
“Heavy AFB Positive”

• Family History
  – Patient’s mother died productive cough and weight loss
Infectiousness

**Transmission** = conveyance of disease from one person to another (an event)

**Infectiousness** = the characteristic of the disease that concerns the ease with which it is transmitted (a capacity)
Case 1: Transmission Questions

- Is she infectious?
- Who has she infected?
- Where and how was she infected?
TB is an Airborne Contagion

- Household / Residential
- Work / School
- Leisure / Recreation
Transmission of TB

- Transmission is **airborne** from patients with **active** pulmonary TB
- **Vehicle:** droplet nucleus (coughing, talking, sneezing); size (1-5 μm)
- **Quantity** of organisms; high with cavitary disease
- **Environment:** spread is enhanced by crowded, poorly ventilated conditions
- Bottom line: duration of exposure and concentration of organisms in the air
Update in 2005 and replaced the 1994 Mycobacterium tuberculosis infection control (IC) guidelines

Purpose: Promote vigilance and expertise needed to avert another TB resurgence
Guidelines

• Broadens the scope of health-care settings
  – Further reduce threat to health-care workers (HCWs)
  – Expand guidelines to nontraditional settings

• Redefines TB risk assessment
  – Simplify procedures for assessing risk

• Changes TB testing frequency for HCWs

• Defines “airborne infection isolation” (AII)

• Summarizes respiratory fit testing

• Expands information on engineering controls
Fundamentals of Infection Control (1)
Hierarchy of Infection Control

- Administrative Controls
- Environmental Controls
- Respiratory Protection
Hierarchy of Infection Control

- **Administrative controls:** reduce risk of exposure via effective IC program
- **Environmental controls:** prevent spread and reduce concentration of droplet nuclei
- **Respiratory protection controls:** further reduce risk of exposure in special areas and circumstances
Administrative Controls (1)

Most Important

• Assign responsibility for TB infection control (IC)

• Work with health department to conduct TB risk assessment and develop written TB IC plan, including All precautions

• Ensure timely lab processing and reporting

• Implement effective work practices for managing TB patients
Administrative Controls (2)

• Test and evaluate HCWs at risk for TB or for exposure to *M. tuberculosis*
• Train HCWs about TB infection control
• Ensure proper cleaning of equipment
• Use appropriate signage advising cough etiquette and respiratory hygiene
Environmental Controls

- Control source of infection
- Dilute and remove contaminated air
- Control airflow
Respiratory Protection (RP) Controls

• Implement RP program
• Train HCWs in RP
• Train patients in respiratory hygiene
Managing Patients

• Triage
• Initiate airborne infection isolation
• Discontinue airborne infection isolation
Triage

- Prompt identification, separation, and transfer of persons suspected of having infectious TB
- Maintaining vigilance is key, especially as TB incidence decreases
- Routinely screen patients for signs and symptoms
Respiratory Isolation?

• Consider “Infectiousness”: The Source
  – Correlates:
    • Coughing, hoarse? (Pulmonary or airways disease)
    • Sputum smear-positive; NAAT-positive (?)
    • ... however, smear-negative may be infectious

• Consider risk to others if infectious: The Setting
  – If vulnerable (e.g., inpatient unit or shelter, or …)
    • Risk of acquiring infection and
    • Possible consequences

• Most suspected cases are managed as out patients
  – Judgment!
Remove from Isolation?

• Airborne precautions can be discontinued when infectious TB disease is considered unlikely and either
  – another diagnosis is made that explains the clinical syndrome,
  – the patient has three negative AFB sputum smear results, or
  – the patient has a sputum specimen that has a negative NAA test result and two additional sputum specimens that are AFB-smear negative.*

  or

  – GeneXpert ® neg x 1 (or 2) – Good sputum samples!**

* CDC Expert Panel on NAAT, MMWR 11/2008
** FDA, 2015
Consensus statement on the use of Cepheid Xpert MTB/RIF® assay in making decisions to discontinue airborne infection isolation in healthcare settings

April 2016

http://www.tbcontrollers.org/resources/airborne-infection-isolation/#.WD7mTE0VCpo
Use of GeneXpert® in making decision to remove a patient from AII *
TST, smears and contagiousness

- 20% of patients with TB who have no immunosuppression will have a negative TST
- ~50% of patients with non-cavitary TB are sputum smear negative
- 5-10% of patients with cavitary TB are smear negative
- TB with positive smears is more contagious than is smear negative TB, but...BOTH are contagious

TST: tuberculin skin test
Training and Educating HCWs

• TB screening policy and program
• Medical clearance for personal respiratory protection
• Fit testing requirements
• Post-exposure evaluation
Exposure Investigation

• Communicate occurrence of exposure to other departments
• Establish exposure timeline
• Identify key contacts
• Notify contacts of exposure and recommendation for evaluation
• Assess transmission
• Identify corrective actions
• Collaborate with local health department
Collaboration Between TB Program and Hospitals: TB Program Perspective

• Any suspected TB case within a hospital is reported to Infection Control Practitioner (ICP)
  – Reported to State TB Program via TB 70 with copy to TB clinic (must be reported to state within 72 hours

• Once reported to clinic, the designated hospital surveillance worker goes to hospital in person:
  – Meets with patient and family
  – Meets with ICP
  – Reviews medical record & obtains or retrieves information needed by clinic (bloodwork, x-ray films, etc.)
  – Begins contact investigation interview process in hospital setting
Collaboration between TB Program and Hospitals: TB Program Perspective - 2

• Hospital surveillance worker brings information to nurse case manager, who then assigns it to a public health representative

• ICP is part of process – will check in with nurse case manager and surveillance worker if necessary arrangements have been made for discharging patient
For Any Patient….

Local Health Department is responsible for:

- Assigning case manager or public health nurse
- Conducting risk assessment for non-adherence; providing DOT, if indicated
- Maintaining ongoing surveillance
- Ensuring contact investigation is completed
- Carrying out mandated responsibility to protect the health of the public
- BUT ALSO – assessing home setting before discharge
Discharge Planning

• Home visit must occur before release: check for
  – Inaccurate addresses?
  – Who is in home?
  – Public health representatives will assess for high risk contacts (children, immune compromised etc.)
  – Evaluation of contacts
  – Can delay discharge of patient (i.e. babysitting in home)
Home Isolation

• Can be used for patients who may be infectious but hospitalization is not necessary (and are discharged according to criteria)

• Criteria for home isolation includes the following factors:
  – Patient capable of self care
  – Does not require hospitalization for other conditions
  – Patient is cooperative, willing to follow infection control practices

• Patient instructed not to leave home except for medical appointments

• Provided with surgical mask to be used in the home

• Home isolation lifted when patient deemed non-infectious
Returning to Work or School

• Very important to many patients
• Review the following to determine eligibility:
  – Assessment of clinical improvement
  – Adherence to medication regimen
  – Characteristics of TB disease
    • MDR vs pan-sensitive organisms
    • Pulmonary TB vs extra-pulmonary disease
  – Characteristics of those who may be exposed
Infection Control in Outpatient TB Clinic

• Administrative Controls
  – Procedures
  – Triaging patients
  – Sputum induction (time between patients)
  – Fit testing

• Environmental Controls
  – Negative Pressure (all exam and sputum collection rooms)
  – Inspected yearly

• Personal Respiratory
  – Surgical masks for suspected patients or known infectious patients
  – Use of N-95 Respirators as appropriate
Outreach workers is aware that patient is infectious
Patient is instructed in appropriate respiratory hygiene
Workers carry:
  – Tissues
  – Surgical masks
  – N-95 respirators for personal use
If patient is still infectious, DOT may be performed:
  – Outside
  – Indoors with windows open
Infection Control In the Field - 2

• If outreach worker is inside home of infectious patient:
  – Patient is advised to wear surgical mask
  – Outreach worker should use personal respiratory protection

• If transporting infectious patient by car or van:
  – Patient should wear surgical mask
  – Car windows should be open
Summary

Keys to good infection control

• Think TB!
• Isolate
• Start 4 drugs (active agents)
• Patient education
• Directly Observed Therapy
• Discharge planning
• Respiratory protection
• Contact Investigation