Infection Control

CRC 330
Cardiorespiratory Care
University of South Alabama
Nosocomial Infection

- Hospital acquired
- 10-40% affect the respiratory system; many fatal
- $ billions
- RT often blamed in the past, been resolved
- Protect ourselves and patients
- Infection control is a major ongoing responsibility
Spread of Infection

Source

Route

Host
Source

- People or contaminated objects
- Self or autogenous infection
- Virulence of Microorganisms varies
- Nosocomial organisms
  - gram negative bacilli
    - *Pseudomonas, enterobacter, klebsiella*
  - gram positive cocci
    - *Staph aureus, streptococcus*
  - fungi
    - *Aspergillus, candida*
Host

- Colonization versus infection
- Infection is based on the host defense and organism virulence
- Factors decreasing host defense
  - Diabetes post-transplant
  - Neoplasia steroids
  - young or old chronic disease
  - post-surgical trauma
Factors Promoting Oropharyngeal Colonization

- Conditions including acidosis, chronic alcohol abuse, coma, diabetes, NGT, etc
- Aspiration leads to pneumonia; normal swallow impaired
- Sedatives and narcotics
- Tracheostomy, intubation
- Personnel handling
Transmission Routes

- Contact
- Droplet
- Vehicle
- Airborne
- Vectorborne
Spread of infection to the lungs

- Aspiration of gastric or oropharyngeal contents
  - Aspiration pneumonia, gram negative, most nosocomial infections
- Inhalation of droplets
  - TB, pneumococcal pneumonia
- From the blood
  - Translocation from the gut
Infection Control Strategies: Break the Chain

- **Decreasing host susceptibility**
  - Patients should be immunized before hospitalization
  - Employees should be immunized for hepatitis B

- **Eliminating the source of pathogens**
  - General sanitation by washing, filtering the air
  - Specialized equipment processing

- **Interrupting routes of transmission**
  - Specialized equipment handling procedures (sterile/aseptic technique)
  - Barrier/isolation precautions
Equipment Processing: Cleaning

- Remove dirt and organics
- Allows higher level processing to work
- Disassemble as possible and wash
- Rinse and dry
- Reassemble in a laminar flow
- Disinfect or sterilize
Physical Disinfection: Pasteurization

- Immersion in hot water (70 C, 30 min.)
- Kills all but spores
- Efficient and cost effective for RT
- Wash all equipment first, then pasteurize
- Aseptically dry, reassemble, and package to prevent recontamination
Chemical disinfection

- Low-level disinfection
  - vinegar and quaternary ammonium compounds
  - home care and surface disinfection

- Intermediate level disinfection
  - alcohol, phenols, iodines
  - skin and surface disinfection
Chemical disinfection

High level disinfection

- destroy all microorganisms except spores
- 2% glutaraldehyde
- Immersion for 20 minutes
- Kills bacteria, fungi and viruses
- If time is increased to 3 hours, it is sporicidal
- Good for any RT equipment that can be immersed
- Toxic and expensive
- Active for 28 days, dilution inactivates it
- Avoid breathing vapors, inflammatory
- Rinse, dry and repackage aseptically
Other high level disinfectants

- Hydrogen peroxide
  - Skin disinfection
  - Useful for cleaning around stomas

- Bleach
  - Surface disinfection
  - Blood spills
Other high level disinfectant

- Peracetic acid (new Cidex, Steris system for scopes)
  - Low concentration (.001-.2%)
  - Kills spores
  - No toxic byproducts
  - New 0.35% solution is stable
  - [http://www.sustainablehospitals.org](http://www.sustainablehospitals.org)
  - Viable replacement for glutaraldehyde
Sterilization

- Complete destruction of all microorganisms, including all spores
- No reusable RT equipment is burned or boiled
- Autoclave
  - steam under pressure (121°C for 15 minutes at 15 psi)
  - clean and wrap equipment before autoclaving
- Gamma radiation
Sterilization: Ethylene Oxide

- Colorless toxic gas
- Wash, dry, repackage and expose to ethylene oxide
- Inflammatory, carcinogenic, and explosive
- Exposed equipment requires aeration
- Can be used to sterilize anything that cannot be immersed
In-use equipment handling

- Nebulizers
- Ventilator circuits
- Resuscitation bags
- Suction systems
- Oxygen therapy equipment
- Pulmonary function equipment

WASH YOUR HANDS
Cleaning and Disinfecting Bronchoscopes

- Clean all external surfaces
- Rinse and drain channels
- Immerse and perfuse channels in high-level disinfectant 20 min.
- Rinse with sterile water
- Dry with air flow
- Store aseptically
Processing reusable equipment

- Dispose of or high level disinfection
- Disposables versus non-disposables
- Re-use of disposables?
- Follow policies regarding the use of solutions
Barrier Measures

- Hand washing
- Gloves
  - anytime there will be or may be contact with blood, body fluid, or condensate
  - protects patients from colonized HCWs
  - reduce cross-contamination
  - always wash hands after glove use
  - know if you are allergic to latex
Barrier Measures

- Masks, gowns, goggles, face shields
  - use as needed if splashing or spraying are potential
  - replace a mask when damp
  - N95 masks are used in suspected cases of TB
  - all are disposed of in the patient’s room
  - hand washing after removing personal protective gear
- Patient placement: private room
- Patient transport
  - usually the patient is to wear a mask and be covered
Barrier Measures

- Handling contaminated articles and equipment
  - bag and dispose of these articles, or transport them to the decontamination area
  - needles and syringes are put in the sharps box in the patient’s room
  - DO NOT recap needles, or use one-hand technique
  - laboratory specimens (i.e. sputum) are placed in a bag
Isolation Precautions

- **Standard Precautions**

- **Airborne precautions**
  - legionellosis, TB, varicella, measles, histoplasmosis
  - special air handling and ventilation
  - private room, door closed, N95 mask for TB
Isolation Precautions

- **Droplet precautions**
  - H flu meningitis, strep, epiglottitis
  - private room, mask within 3 feet

- **Contact precautions**
  - AIDS, MRSA, VRE
  - private room, gloves, gown if near the patient

- **Immunocompromised and burn patients**
  - most common source of infection is their own flora
  - private room
  - contact isolation precautions
Surveillance Programs

- Equipment processing quality control
  - Adherence to procedures
  - Effectiveness of procedures
    - Processing indicators
    - Culture sampling
- Sampling of in-use equipment
  - Identify cycle of replacement and source of infection
    - Swab, rinse, and impaction sampling
Sputum Culturing

- Expectoration
  - wash mouth with water
  - cough deeply to obtain bronchial specimen
  - expectorate into a sterile cup
  - send to lab for prompt culturing
- Trans-tracheal aspiration
- Bronchoscopy
Filters

- Dust particle filters
  - remove dirt and dust from the air surrounding electrical and mechanical equipment
  - wire mesh, porous metal, mineral or vegetable fibers, sponge
  - 5-40 microns
  - prevent wear and malfunction
Filters

- Copper
- HEPA
  - inspiratory, before the humidifier
  - 99.97% of bacteria are filtered (< .3 microns)
  - membrane papers containing cellulose
  - impaction or diffusion filtration
  - hyperclean environments
TB Infection Control

- Patients are infective if they are
  - Coughing, are undergoing cough-inducing or aerosol generating procedures, or have sputum smears containing AFB and
  - not receiving therapy, have just started therapy, or have a poor clinical or bacteriologic response to therapy
Infection Control

- Patients are considered non-infectious if they meet the following criteria
  - On adequate therapy
  - Significant clinical response to therapy
  - Three consecutive negative smears results from sputum collected on different days
  - Airborne precautions may be discontinued at that time
Infection Control

- Administrative controls
  - Develop and implement policy to identify, isolate, evaluate, and treat susceptible persons
  - Implement effective work practices among HCWs
  - Educate, train and counsel HCWs about TB
  - Screen HCWs for TB infection and disease
  - RTs: remember the signs and symptoms
Infection Control

- Engineering controls
  - Prevents the spread and reduces the concentrations of infectious droplet nuclei
  - Negative pressure isolation rooms; door closed
  - HEPA filters
  - Ultraviolet light installed near ceilings
Infection Control

- Personal respiratory protection
- Use only NIOSH approved particulate respirators
- Train patients on respiratory hygiene and cough etiquette
Mechanical Ventilation of a TB Patient

- Place a bacterial filter on the patient's endotracheal tube (or at the expiratory side of the breathing circuit of a ventilator)
- Filter particles 0.3 µm in size in both the unloaded and loaded states
  - filter efficiency of >95% (i.e., filter penetration of <5%) at the maximum design flow rates of the ventilator for the service life of the filter.
Bronchoscopy and TB

- Avoid it if possible, until AFBs are (-)
- Negative pressure room and ultraviolet light
- N95 disposable respirator (e.g., an elastomeric full-facepiece respirator or a powered air-purifying respirator [PAPR])
- Allow adequate time to elapse after procedure for air exchange
Screening HCWs for TB

- HCWs who:
  - Enter TB patient or treatment rooms, whether or not the patient is present
  - Participate in aerosol generating procedures
  - Participate in M TB specimen processing
  - Install, maintain, replace environmental controls in areas where TB patients are encountered,

Should participate in TB screening (TST)
Screening HCWs for TB

- All new hires
  - Baseline two-step TST (2nd test 1-3 weeks after the 1st)
- Annually
  - TST
- As needed in investigation of potential ongoing transmission
- Upon unprotected exposure
  - One TST ASAP after exposure. If (-), another 8-10 weeks later.

CDC, MMWR, 12/30/2005 / 54(RR17); 1-141
If You Have a Positive TST

- Chest radiograph to r/o TB disease
- If TB disease:
  - Leave work until AFB is (-)
  - Return when you have responded to effective treatment
  - You are declared noninfectious by a physician knowledgeable and experienced in managing TB disease
If you have LTBI

- You can return to work immediately.
- HCWs with LTBI who cannot take or do not accept or complete a full course of treatment for LTBI should not be excluded from the workplace.
- Counsel regarding the risk for developing TB disease and instructed to report any TB symptoms immediately to the occupational health unit.
Your Hospital’s Program Should Include

- Nature, extent, and hazards of TB disease
- The risk assessment process and its relation to the respirator program
- Signs and symbols used to demonstrate that respirators are required in an area
- Reasons for using respirators
- Environmental controls used to prevent the spread and reduce the concentration of infectious droplet nuclei
Your Hospital’s Program Should Include

- Operation, capabilities, and limitations of respirators
- Cautions regarding facial hair and respirator use
- Applicable federal, state, and local regulations regarding respirators
- Opportunities to handle and wear a respirator
- Educational material for use as references
- Instructions to refer all respirator problems immediately to the respirator program administrator
Famous Victims of TB

- King Tutankhamen
- Sir Walter Scott
- Niccolo Paganini
- Ralph Waldo Emerson
- Edgar Allan Poe
- Frederic Chopin
- Robert Louis Stevenson

- Satine in Moulin Rouge
- Kate Winslet’s character in Finding Neverland
TB Resources

- Centers for Disease Control
  - http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm

- National TB curriculum consortium
  - http://ntcc.ucsd.edu/

- Alabama Dept of Public Health
  - http://www.adph.org/tb/