Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Mary Bennett RN CIC
Director of Infection Control
Excellentia Advisory group

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

The overall risk of health care associated infection is lower in ambulatory settings than in acute care settings.

- Patient stays are of shorter duration.
- Patients are healthier.
- Less environmental contamination.
- Elective surgical procedures have lower risk of post-op infections than urgent procedures.

But some trends in health care are affecting the risk:

- Increasingly complex invasive procedures are being performed in ambulatory settings.
- There is an increasing number of immunocompromised patients.
- Increased patient acuity as health care delivery continues to shift from hospital settings.

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Risk of Health Care Associated Infection during patient care in any health care setting is related to:

- Mode of transmission of the infectious agent.
- Type of procedure or patient care activity.
- Duration of exposure.
- Inoculum of the infectious agent.
- Pathogenicity of the infectious agent.
- Underlying host defenses.

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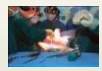
Surgical Site Infection or SSI is the third most common Healthcare Associated Infection (HAI).

Most SSI are associated with microbial contamination of the wound during the procedure.

The patient's endogenous bacteria are the primary source of an SSI.

Exogenous sources may be from the operating room environment, instruments, employees.



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Almost every surgical site is contaminated with bacteria by the end of the procedure, but not all of these surgical sites become infected.

The likelihood of infection is determined by the interaction of four variables:

- Inoculum of bacteria or the amount of contamination.
- Virulence of the bacteria.
- Micro-environment of the surgical site.
- Host defenses.

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The inoculum of bacteria:

- The number of bacteria contaminating a wound is a factor in the development of SSI.
- Each species has a unique threshold at which it causes infection.
- A procedure that invades a heavily colonized body site, results in a larger inoculum of bacteria.
  - Respiratory tract
  - GI tract
  - Female GU tract
  - Oral cavity

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Virulence of the micro-organisms is a second variable which contributes to SSI.

- Virulence is the measure of the organism's ability to invade and create disease.
- A more virulent organism requires a smaller inoculum to initiate an infection.
- The virulence of an organism is associated with a number of factors.

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Factors related to virulence of a micro-organism:

- The ability to survive in the environment between hosts.
- The mechanism for transmission to a a new host.
- The ability to adhere to a structure it will infect.
- Mechanism for proliferation.
- Elements that favor invasion and dissemination.
- The ability to evade host defenses.

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The micro-environment of the surgical wound:

- Iron from hemoglobin in a hematoma stimulates proliferation of bacteria.
- Processes that help organisms avoid phagocytosis.
  - Foreign bodies provide surface for proliferation.
  - Necrotic tissue shelters organisms.
  - Accumulation of serum and inflammatory fluids in a dead space present in the wound.

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Efficacy of host defenses:

Differences in individual host defenses due to genetic variability.

Actions that breach or bypass body defenses, disrupt the integrity of skin and mucous membranes, IV access, intubation, instrumentation of urinary tract etc.

Immunosuppressive therapy including steroid use.

Morbid obesity.

Infection at other sites.

Extremes of age.

Low albumin.

Adequacy of vascular supply at the wound.

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Efficacy of Host Defenses:

Neutropenia.

Diabetes.

Cancer.

Pre-op nasal colonization with S. aureus.

Peri-operative transfusion.

Nicotine

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The patient's SSI risks are similar whether the procedure is done at an outpatient or inpatient facility:

- Antimicrobial prophylaxis.
- Duration of surgery.
- Pre-op preparation.
- Provision of sterile instruments.
- Surgical technique.
- Traffic control.
- Ventilation.

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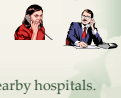
Surveillance for SSI associated with the ambulatory setting is a challenge.

- Medical records are often unavailable after discharge.
- Patients with infections present to their health care provider instead of the surgery facility.

A combination of approaches to surveillance is most effective.

- Letters with a list of surgeries sent to provider with request for feedback.
- Patient phone contacts.
- Review of culture reports.
- Network with infection preventionists at nearby hospitals.



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CDC definitions of SSI that categorize severity of the infection:

1. Superficial incisional SSI.
2. Deep incisional SSI.
3. Organ/space SSI.

These definitions are used for reporting infections to the National Health Care Safety Network.

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Superficial Incisional SSI

The infection occurs within 30 days of the operation and involves only skin or subcutaneous tissues of the incision and at least one of the following:

1. Purulent drainage, with or without laboratory confirmation, from the superficial incision.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
3. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness or heat and superficial incision is deliberately opened by surgeon, unless incision is culture negative.
4. Diagnosis of a superficial incisional SSI by the surgeon or attending physician.

Do not report the following conditions as an SSI:

1. Stitch abscess.
2. Infection of episiotomy, newborn circumcision, infected burn wound.
3. Incisional SSI that extends into the fascial or muscle layers.

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Deep Incisional SSI

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves deep soft tissues (fascia and muscle layers) of the incision and at least one of the following:

1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38 C) localized pain, or tenderness, unless the site is culture negative.
3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathological or radiological examination.
4. Diagnosis of a deep incisional SSI by a surgeon or attending physician.

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Organ/Space SSI

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves any part of the anatomy (organs or spaces), excluding the skin incision, fascia and muscle layers that is opened or manipulated during an operation and at least one of the following;

1. Purulent drainage from a drain that is placed through a stab wound into the organ/space.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.
3. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathological or radiological examination.
4. Diagnosis of an organ/space SSI by a surgeon or attending physician.

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NNIS Risk Index is used to predict risk of SSI and has a range of 0-3 points

Uses the following variables, one point is added for each:

- Surgical wound classification.
  - Classification of contaminated or dirty (class III or IV.)
- ASA score.
  - Score rated by anesthesiologist of 3 or above.
- Procedure time in minutes.
  - Threshold is the 75th percentile of duration for the specific procedure determined by the NNIS database.

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How is risk classification useful?

- It is procedure specific addresses microbial wound burden, patient specific risk factors, and complexity of the surgical procedure.
- It allows monitoring of trends.
- Useful for monitoring outcome vs. risk.
- Useful decision tool.

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Prevention of Surgical Site Infection

Attempt to counteract events associated with infection:

- Limit access of bacteria to the surgical site.
- Measures to neutralize bacteria that gain access to the surgical site.
- Reduction of effects that create a wound environment conducive to infection.
- Optimizing host to enhance host responses.

These are actions we take (or should be taking) every day.

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Limiting bacterial access to the surgical site:

- Skin preparation:
  - Pre-op bath or shower.
  - Skin prep.

- Barriers, sterile draping, sterile gowns and gloves.
- Surgical scrub of hands and forearms.
- Surgical attire.
- Sterilization of instruments.

- Traffic control in the OR.
- Ventilation control.
- Environmental cleaning and disinfection.

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Measures to neutralize bacteria that gain access to the surgical site, findings from well controlled studies:

- Preventive systemic antibiotics demonstrated benefit when:
  - Administered before or at time of microbial contamination (before incision)
  - Drug is effective against pathogens likely to be encountered
- Antibiotics given after contamination occurred had no impact.
- Antibiotics begun after wound closure did not prevent infection.
- Prolonged administration of antibiotics after the procedure did not improve results.

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Reduction of effects that create a wound environment conducive to infection:

- Surgical technique:
  - Hemostasis.
  - Removal of devitalized tissue.
  - Eliminating dead space.
  - Appropriate use of drains and suture material.
  - Gentle handling of tissues.

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Optimizing the patient to enhance host responses:

- Maintaining normothermia.
- Blood glucose control.
- Treat infections at other body sites before surgery.
- Smoking cessation.
- Supplemental Oxygen may enhance phagocytosis but additional studies are needed to validate usefulness for SSI prevention.

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Other infection risks in ambulatory settings:

Common waiting rooms:

- Patients and family are in relatively close proximity in a waiting room.
- Increased risk for droplet and airborne infection transmission between persons in close proximity.
- Close proximity increases the likelihood of contact or indirect contact transmission.
- Magazines and toys are potential fomites.



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What do we do about infection risks in our waiting room?

- Signage that informs persons how to report illness
- Develop a system to promptly identify and assess and manage persons who present with symptoms of illness:
  - Productive cough.
  - Undiagnosed rash.
  - Nausea/vomiting /diarrhea.
  - Wound drainage.
  - Redness/drainage from eyes.
- If toys are provided they should be easily cleaned, and you must have a schedule to clean and disinfect them on a frequent and regular basis.

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For your waiting room and other areas of your facility:

- Post a Cover your Cough sign.
- Provide in an easily accessible area:
  - Tissues.
  - Hand sanitizer.
  - Masks.
  - Trash receptacle.

http://www.cdc.gov/flu/protect/covercough.htm Print Cover Your cough signs

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2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

- Standard Precautions are used with all patient encounters
- Transmission Based Precautions are used in conjunction with standard precautions if additional measures are necessary to interrupt transmission
- Appendix A

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Standard Precautions:

Applies to all blood, body fluids, excretions, secretions (except sweat) whether or not visible blood is present non-intact skin and mucous membranes.

Reduces the risk of transmission from recognized and unrecognized sources of infection. Use these precautions during the care of all patients.

- Hand washing/hand hygiene.
- Gloves must be worn when touching or if contact is expected with blood, body fluids, secretion, excretions, non-intact skin or mucous membrane, and contaminated items.
- Gowns are used to protect skin and prevent soiling clothing during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.

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Standard Precautions:

- Mask, eye protection, or face shield must be worn during patient care activities that are likely to generate splashes or sprays of blood or body fluids secretions or excretions.
- Used patient care equipment and supplies soiled with blood, body fluids, secretions, and excretions must be handled in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to other patients and environments. Single-use items should be discarded in the appropriate manner.
- Linen contaminated with blood, body fluids, secretions and excretions will be handled, transported, and processed in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to other patients, personnel, and environments.
- Environmental cleaning and disinfection using EPA registered disinfectant.
- Handling contaminated wastes.

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Additional aspects of standard precautions:

Respiratory Hygiene/Cough Etiquette: Implement the following measures to contain respiratory secretions in patients and accompanying individuals who have signs and symptoms of a respiratory infection, beginning at the point of initial encounter:

- Post signs at entrances and in strategic places with instructions for patients and persons with symptoms of respiratory infection to cover their mouths/noses when coughing or sneezing, use and dispose of tissues, and perform hand hygiene after hands have been in contact with respiratory secretions.
- Provide tissues and no-touch receptacles for disposal of tissues
- Provide resources and instructions for performing hand hygiene in or near waiting areas , conveniently-located dispensers of alcohol-based hand rubs and, where sinks are available, supplies for hand washing
- During periods of increased prevalence of respiratory infections in the community offer masks to coughing patients and other symptomatic persons (e.g., persons who accompany ill patients) upon entry into the facility and encourage them to maintain special separation, ideally a distance of at least 3 feet, from others in common waiting areas

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Safe Injection Practices: The following recommendations apply to the use of needles, cannulas that replace needles, and, where applicable intravenous delivery systems

- Use aseptic technique to avoid contamination of sterile injection equipment
- Do not administer medications from a syringe to multiple patients, even if the needle or cannula on the syringe is changed. Needles, cannulae and syringes are sterile, single-use items; they should not be reused for another patient nor to access a medication or solution that might be used for a subsequent patient [453, 919, 1004, 1005].
- Use fluid infusion and administration sets (i.e., intravenous bags, tubing and connectors) for one patient only and dispose appropriately after use. Consider a syringe or needle/cannula contaminated once it has been used to enter or connect to a patient's intravenous infusion bag or administration set [453].
- Use single-dose vials for parenteral medications whenever possible
- Do not administer medications from single-dose vials or ampoules to multiple patients or combine leftover contents for later use
- If multidose vials must be used, both the needle or cannula and syringe used to access the multidose vial must be sterile
- Do not keep multidose vials in the immediate patient treatment area and store in accordance with the manufacturer's recommendations; discard if sterility is compromised or questionable
- Do not use bags or bottles of intravenous solution as a common source of supply for multiple patients

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Infection Control Practices for Special Lumbar Puncture Procedures:

- Bacterial meningitis following myelogram and other spinal procedures (e.g., lumbar puncture, spinal and epidural anesthesia, intrathecal chemotherapy) has been reported.
- Face masks are effective in limiting the dispersal of oral-pharyngeal droplets
- Wear a surgical mask when placing a catheter or injecting material into the spinal canal or subdural space (i.e., during myelogram, lumbar puncture and spinal or epidural anesthesia.

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Droplet transmission of infection can occur when:

Respiratory droplets that contain an infectious agent are expelled and contact with mucous membranes or conjunctiva occurs.

An employee, visitor, or family member has a respiratory disease spread by droplets and respiratory hygiene measures aren't followed.

A patient has a disease spread via droplets is not placed on droplet precautions.

Indirect acquisition of an infectious agent after touching surfaces contaminated by a person with respiratory illness who has touched the surface or surface contamination with respiratory droplets.

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Droplet precautions:

- Place patients who require Droplet Precautions in an examination room or cubicle as soon as possible. Instruct patient to follow recommendations for Respiratory Hygiene/Cough Etiquette
- Spatial separation of > 3 feet and drawing the curtain between patient beds is especially important for patients in multi-bed rooms with infections transmitted by the droplet route.
- Don a mask upon entry into the patient room or cubicle
- Change protective attire and perform hand hygiene between contact with patients in the same room, regardless of whether one patient or both patients are on Droplet Precautions
- Patients on Droplet Precautions who must be transported outside of the room should wear a mask if tolerated and follow Respiratory Hygiene/Cough Etiquette. No need for employees to wear mask while transporting if the patient is masked.

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Airborne infection transmission can occur when:

A patient with respiratory infection is not recognized and remains in the environment with others.

A visitor or family or employee has a respiratory disease such as chicken pox, TB, or measles.

Micro-organisms contaminate the ventilation system.

Water system and HVAC system contaminated with waterborne bacteria which become aerosolized and are inhaled.

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Airborne precautions:

Airborne Precautions prevent transmission of infectious agents that remain infectious over long distances when suspended in the air.

In ambulatory settings:

- Develop systems (e.g., triage, signage) to identify patients with known or suspected infections that require Airborne Precautions upon entry into ambulatory settings
- Place the patient in an Airborne Infection Isolation Room (AIIR) as soon as possible. If an AIIR is not available, place a surgical mask on the patient and place him/her in an examination room. Once the patient leaves, the room should remain vacant for the appropriate time, generally one hour, to allow for a full exchange of air
- Instruct patients with a known or suspected airborne infection to wear a surgical mask and observe Respiratory Hygiene/Cough Etiquette. Once in an AIIR, the mask may be removed; the mask should remain on if the patient is not in an AIIR

(AIIR is a room with 6-12 air exchanges per hour, monitored negative air flow, air exhausted outdoors or HEPA filtered before recirculation)

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- Restrict susceptible healthcare personnel from entering the rooms of patients known or suspected to have measles (rubeola), varicella (chickenpox), disseminated zoster, if other immune healthcare personnel are available
- Use of PPE Wear a fit-tested NIOSH-approved N95 or higher level respirator
- In settings where Airborne Precautions cannot be implemented due to limited engineering resources, masking the patient, placing the patient in a private room with the door closed, and providing N95 or higher level respirators or masks if respirators are not available for healthcare personnel will reduce the likelihood of airborne transmission until the patient is either transferred to a facility with an AIIR or returned to the home environment, as deemed medically appropriate.

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Direct Contact transmission can occur by:

- Direct contact, touching infectious material from another person
- Direct contact with blood, body fluids, secretions during
  - Patient care
  - Interactive activities in play or lounge areas

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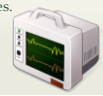
Indirect Contact Transmission can occur by contact with contaminated intermediate surface or substance when:

- Hand hygiene is not adequately performed by a caregiver
- Equipment is not adequately cleaned, disinfected or sterilized between patients
- High touch surfaces are not cleaned and disinfected frequently
- Sanitation standards are not maintained when food and water supplies are prepared.
- Improper disposal of sharps and biohazard waste.
- Industry standards are not followed when preparing, storing or administering pharmaceutical supplies.



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Contact precautions:

- In ambulatory settings, place the patient in an examination room or cubicle as soon as possible ».
- Use of personal protective equipment
  - Gloves: Wear gloves whenever touching the patient's intact skin or surfaces and articles in close proximity to the patient. Don gloves upon entry into the room or cubicle.
  - Gowns: Wear a gown whenever anticipating that clothing will have direct contact with the patient or potentially contaminated environmental surfaces or equipment in close proximity to the patient. Don gown upon entry into the room or cubicle. Remove gown and observe hand hygiene before leaving the patient-care environment
    - After gown removal, ensure that clothing and skin do not contact potentially contaminated environmental surfaces that could result in possible transfer of microorganism to other patients or environmental surfaces

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- Handle patient-care equipment and instruments/devices according to Standard Precautions
- Place contaminated reusable noncritical patient-care equipment in a plastic bag for transport to a soiled utility area for reprocessing.
- When transport or movement in any healthcare setting is necessary, ensure that infected or colonized areas of the patient's body are contained and covered.
- Ensure that rooms of patients on Contact Precautions are prioritized for frequent cleaning and disinfection with a focus on frequently-touched surfaces (e.g., bed rails, over bed table, bedside commode, lavatory surfaces in patient bathrooms, doorknobs) and equipment in the immediate vicinity of the patient.

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Interrupting Transmission:

- Use standard precautions during every patient encounter.
- Transmission based precautions address the route of transmission of specific infectious agents and are used if additional measures are needed to interrupt transmission.
- Transmission based precautions do not stand alone; they are always used in conjunction with standard precautions.
- Ambulatory care facilities are not usually designed to implement all aspects of the transmission based precautions.
- Have a plan to identify potentially infectious persons, to separate them from others and, and a system for transfer to a facility that can fully implement precautions.

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Where can I find information about transmission based and standard precautions?

2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings has specific information about the precautions

http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html

If you need information about the precautions necessary for a specific pathogen, look in Appendix A

http://www.cdc.gov/hicpac/2007IP/2007ip_appendA.html

For examples of safely donning and removing PPE, look here:

http://www.cdc.gov/hicpac/2007IP/2007ip_fig.html

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Sample of information from Appendix A

Infection/Condition	Type *	Duration	Precautions/Comments
Gastroenteritis C. difficile	C	DI	Discontinue antibiotics if appropriate. Do not share electronic thermometers 853, 854; ensure consistent environmental cleaning and disinfection. Hypochlorite solutions may be required for cleaning if transmission continues 847. Handwashing with soap and water preferred because of the absence of sporicidal activity of alcohol in waterless antiseptic handrubs 983.

*Type of Precautions: A, Airborne Precautions; C, Contact; D, Droplet; S, Standard; **when A, C, and D are specified, also use S.**

Duration of precautions: CN, until off antimicrobial treatment and culture-negative; DI, duration of illness (with wound lesions, DI means until wounds stop draining); DE, until environment completely decontaminated; U, until time specified in hours (hrs) after initiation of effective therapy; Unknown: criteria for establishing eradication of pathogen has not been determined

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Specific Micro-organisms of Concern:

- Staphylococcus aureus:
  - MRSA
    - ✓ Community Associated MRSA (CA MRSA)
    - ✓ Hospital Associated MRSA (HA MRSA)
- Clostridium difficile.
- Influenza.

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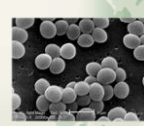
Features of Staphylococcus aureus infections:

- Suppurative infections of soft tissue, bone, closed spaces, heart valves.
- Exceptional ability to form metastatic infections when blood stream is involved.
- Localized infections with abscess formation.
- Disseminated infection via spread through blood stream.
- Toxin mediated syndromes:
  - Staphylococcal food poisoning.
  - Toxic shock syndrome.
  - Staphylococcal scalded skin syndrome.



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S. aureus is a highly versatile organism:

- Produces a variety of protein such as enzymes, toxins and adhesins.
- Enzymes may inhibit destruction by white cells, hyaluronidase enhances ability to spread through tissues and form abscesses.
- Exfoliative toxins are responsible for skin effects.
- A- hemolysin lyses a wide range of host cells.
- PVL destroys leukocytes by creating pores in cell membranes.
- Protein A is a bacterial surface protein adhesin .
- Peptidoglycan, a polysaccharide that makes up 50% of the cell wall may be an important factor in sepsis picture.

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Methicillin Resistant Staphylococcus aureus(MRSA)

Bacteria develop resistance by exchanging genetic material the *mec*A gene on a mobile DNA element .

Genes encode for antibiotic resistance.

HA-MRSA strains may be multi drug resistant to:

- Beta lactam antibiotics and other classes of antibiotics.
  - Macrolides
  - Ketolides
  - Lincosamides
  - Tetracyclines
  - Quinolones
  - Aminoglycosides

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CA-MRSA

Emergence of MRSA infections in healthy persons in the community with no apparent risk factors including hospitalization.

Worldwide distribution.

Microbiologically distinct from strains endemic in health care settings.

Gene types have lost several typical resistance markers found in HA-MRSA, clindamycin and macrolide resistance.

Susceptible to more antibiotics than HA-MRSA.

In the community, primarily causes skin and soft tissue infections but can cause invasive infection.

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CA-MRSA

Virulence factors may allow it to spread more easily and cause more skin disease.

More likely to carry a virulence factor called Panton-Valentine leukocidin (PVL) that destroys leukocytes and may offer selective advantage for transmission.

Strains that carry PVL are capable of causing severe necrotizing pneumonia following viral infections .

CA-MRSA has found it's way into health care facilities.

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Transmission of MRSA in health care facilities :

Primarily spread via hand carriage by staff and caregivers.

Environment has a secondary role.

Asymptomatically colonized persons may be an endogenous reservoir for infections and a reservoir for transmission to others.

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Management of MRSA Infections:

- Eradication of colonization.
- Nasal carriage is a source and a risk for infection :
  - Treatment of colonization may be of benefit, studies show reduced infections when nasal colonization is reduced prior to surgery.
  - Recolonization and relapse are frequent occurrences.
- For skin and soft tissue infection, incision and drainage is the first consideration and is essential to eliminating the infection.
- Beta-lactam antibiotics are not adequate to treat MRSA .
- HA-MRSA is resistant to other antibiotic classes. Vancomycin and newer antibiotics such as linezolid, daptomycin, tigecycline or synercid may be drugs of choice.

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- Vancomycin is the drug of choice for severe MRSA infections except bacteremic pneumonia.
- Avoid quinolones because resistance develops during treatment
- Resistance to rifampin, fusidic acid and fosfomycin develops quickly and these must always be given in combination with another antibiotic.
- Linezolid is approved in the US for treatment of nosocomial pneumonia and complicated skin and skin structure infections and has favorable lung pharmacokinetics.

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Prevention, use multiple interventions:

- Hand hygiene. Consistent performance of hand hygiene is a chief recommendation to prevent MRSA transmission.
- Contact precautions, prevent direct and indirect contact with the micro-organisms. Use of barriers reduces contamination of health care workers skin and clothing and subsequent transmissions to other areas of the environment.
- Surveillance , calculating rate of infections with the organism to identify trends.
- Environmental cleaning and disinfection instrumental for control of environmental contamination. Pay special attention to high touch surfaces. Use an FDA approved disinfectant.
- Patient and staff education.

http://www.epa.gov/oppad001/list_h_mrsa_vre.pdf

http://www.epa.gov/oppad001/list_b_tuberculocide.pdf

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Clostridium difficile:

- Spore forming anaerobic bacillus.
- Produces two toxins, A and B which cause diarrhea and colitis.
- New strain with binary toxin is more virulent and has increased sporulation, produces larger amount of toxins and causes more severe disease.
- Some strains of C. difficile are not toxogenic.
- Rates of C. difficile infection has tripled since year 2000 in the US.
- High risk environments, that have heavy antibiotic use and environment heavily contaminated with C. difficile spores.
  - Acute Care Hospitals.
  - Long Term Care Facilities.
- Spores can survive for months in the environment.

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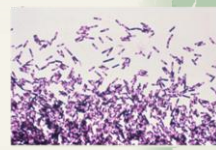
Risk factors for C. difficile Infection:

- Antimicrobial administration.
- Acquisition of C. difficile.
- Advanced age.
- Gastric acid suppression ?
- Immunosuppression.
- Intestinal tube feedings.



Transmission of C. difficile infection:

- The hands of health care workers.
- Transfer of spores from the contaminated environment.

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Highest risk health care environments for patients to acquire C. difficile infection or colonization are hospitals and Long term care facilities.

Ambulatory care and surgery facilities may receive as patients persons who have been in a hospital or reside in a long term care facility.

Transmission of C. difficile to patients has occurred in ambulatory surgery settings after receiving one dose of antibiotic prophylaxis.

Risk factors which have potential for modification:

- Antimicrobial usage.
  - Disrupts normal flora in digestive system.
- New acquisition of C. difficile organism.
  - Acquired by oral ingestion.
  - Spores are resist stomach acid and then germinate in the intestinal tract causing disease..

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Clinical manifestations of C.difficile infection:

- Diarrhea 3-20 bowel movements per day consistency varies.
- Abdominal pain and cramping.
- Leukocytosis >10,000 wbc per cubic mm.
- High risk of fulminant infection in persons with ileus.
- Pseudomembranous colitis which can lead to:
  - Toxic mega-colon (high mortality).
  - Sepsis.
  - Death.

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Asymptomatic colonization with C. difficile can occur.

- Persons with asymptomatic C.difficile colonization:
  - Are at decreased risk of infection
  - Young children may be a reservoir of organisms that can be transmitted.
  - Have moderate amounts of environmental contamination with spores in their rooms.
- Persons with C. difficile infection and diarrhea may have a large amount of environmental contamination of their room with spores

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Core Measures

- Contact precautions (duration of illness)
- Hand hygiene in compliance with CDC/WHO guidelines. **
- Cleaning and disinfection of environment and equipment.**
- Laboratory-based alert system.
- Surveillance.
- Education.

** QA/PI Monitoring recommended.

Supplemental Measures

- Prolonged duration of contact precautions
- Presumptive isolation.
- Soap and water hand hygiene after leaving patient room cubicle.
- Universal glove use.
- Bleach for environmental disinfection.
- Antimicrobial stewardship program

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The two reservoirs of C. difficile in the health care environment are infected persons, either symptomatic or asymptomatic and inanimate objects.

Transmission by transient contamination of health care worker's hands is thought to be the mode of transmission and can be transmitted from the environment to the patient during patient care activities.

Alcohol based had rubs do not destroy the spores.

Spores are difficult to remove by hand hygiene methods.

Universal glove use reduces CDI rates.

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Burden of Disease:

Between 2001 and 2005. the number of discharged persons with diagnosis of C. difficile infection (CDI) has increased dramatically.

Persons over 65 years of age reflect two thirds of the cases.

Severity of illness increased during this time period.

In the US, persons with CDI listed on their death certificate increased from 5.7 per million of population in 1999 to 23.7 in 2004.

CDI has occurred in health persons without exposure to antibiotics or health care facility exposures.

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Because of the changing epidemiology of C. difficile disease, CDI should be considered in any person with diarrhea lasting longer than 3 days with fever and abdominal pain.

Ask patients at intake about a history of diarrhea.

- If you suspect a patient in your center may have CDI, contact the patient's surgeon or attending physician so that the patient can be evaluated, and receive follow-up.
- Implement contact precautions.
- Wear gloves.
- Do not use electronic temperature probes.
- Traditional disinfectants may encourage sporulation of the organisms , environmental cleaning and disinfection including high touch surfaces requires a disinfectant proven to destroy C. difficile spores.
  - •Bleach-containing disinfectant (5000 ppm) for environmental disinfection .
  - ✓Chlorine bleach solution. (See handout ,mix fresh daily)
  - ✓Dispatch (commercial product).

Educate staff and patients about disease process and how to prevent transmission

Treatment of C. difficile infection:

- Discontinue the provoking antibiotic whenever possible
- Therapy with
  - •Oral Vancomycin (preferred for more severe infections)
  - •Oral metronidazole
- Re-occurrence of diarrhea in 15-25% of patients with either drug
- Early re-occurrences within 30 days are usually relapses with the same organism
- Later re-occurrences are likely to be caused by a different strain.
- Only symptomatic patients should be treated.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Influenza:

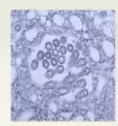
- Influenza is a highly infectious viral illness.
- The first pandemic that clearly fit the description of influenza was in 1580.
- In the 19th century, there were at least 4 pandemics, 3 in the 20th century and one in the 21st century.

Impact of Influenza:

- 200,000 excess hospitalizations per year.
- Average of 23,607 deaths per year for flu seasons beginning 1976-2006.
- Persons age 65 or older account for 90% of deaths.
- Greater numbers of hospitalization and 2.7 times more deaths during seasons when A (H3N2) viruses predominate.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

The Influenza viruses, three categories:

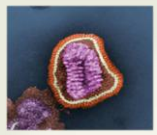


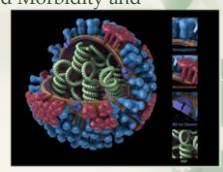
- Influenza A.
  - Causes moderate to severe illness.
  - Affects all age groups.
  - Can infect humans and other animals and are perpetuated in nature by wild birds.
  - Sub-typed based on two surface proteins.
    - ✓ H hemagluttinin
    - ✓ N neuraminidase
- Three H and two N antigenic types account for almost all human infections.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

- Influenza B:
  - Can cause epidemics.
  - Clinical illness tend to be milder.
  - Primarily affects children.
  - Virus infects only humans.
- Influenza C:
  - Doesn't cause epidemics.
  - Less common.
  - Mild illness.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality





Influenza A viruses can change by the mechanism of antigenic drift which involves minor changes in the surface antigens

Or they can change by antigenic shift which is a major change in one or both surface antigens probably due to a genetic recombination between 2 influenza A viruses. These novel viruses can cause a pandemic if the virus spreads efficiently from person to person

Influenza B viruses are more stable they do not undergo antigenic shift.

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Transmission of Influenza

- Primarily by large respiratory droplets and respiratory secretions that contaminate mucous membranes and environmental surfaces.
- Virus attaches to and penetrates epithelial cells in trachea and bronchi.
- Viral replication destroys the host cells
- Incubation average 2 days range 1-4 days..
- Viral shedding begins 24-48 hours after infection about 24 hours before onset of symptoms in adults.
- Viral shedding lasts about 5 days but may last longer in children and the immunosuppressed
- Adults can transmit virus 1 day before symptoms begin to about 5 days after beginning of symptoms
- In nursing homes attack rates up to up to 60%, fatality rate up to 30%

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Clinical presentation:

- May vary from asymptomatic infection to prostration.
- Classical presentation, occurs in 50%of cases, sudden onset of :
  - Fever
  - Myalgia
  - Headaches
  - Sore throat
  - Non-productive cough

- Children may present with otitis media, nausea and vomiting, and in young children symptoms resembling bacterial sepsis.
- Fewer than half of elderly patients present with fever, cough, and acute onset.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Treatment of Influenza:

- In most instance rest and supportive treatment is sufficient.
- Antiviral medication is available.
- Many strains resistant to amantadine and rimantadine, they are not currently recommended for treatment or chemoprophylaxis unless virus is shown to be sensitive.
- Neuraminidase inhibitors, oseltamivir given orally and zanamavir given by inhalation.
  - ✓ Effective against Type A and Type B.
  - ✓ Approved for treatment and for prophylaxis within listed age groups.
  - ✓ Influenza A viruses increasingly resistant to oseltamivir .
  - ✓ CDC recommends persons positive for Influenza A be given zanamavir if treatment is needed.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Complications of Influenza:

- Viral pneumonia
- Bacterial pneumonia
- Exacerbation of underlying medical conditions

Persons at greatest risk for complications

- Young children
- The elderly
- Persons with certain chronic illness
  - Cardiovascular
  - Renal
  - Pulmonary
  - Metabolic
  - Hematologic
  - Neurologic
  - Children on long term aspirin therapy who are at risk for Reyes Syndrome

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Prevention of Influenza:

- Vaccination for influenza remains the primary method of prevention
- Two types of vaccine available in the US
  1. Trivalent inactivated vaccine (TIV)
     - Contains 3 inactivated virus, 2 type A and 1 type B
     - Given by Intramuscular injection
     - Grown in chicken eggs and contains trace of residual egg protein
     - Flu shot will not cause flu, it contains no live virus particles

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

2. Live Attenuated Influenza Vaccine (LAIV) approved for use in 2003.
   - Contains the same three influenza viruses as TIV
   - Viruses in vaccine are cold adapted and will only replicate efficiently in the naso-pharynx mucosa
   - Given by intra-nasal route
   - Contains residual egg protein
   - Does not contain preservative or thimerosal.
   - Approved for use only in healthy non-pregnant person aged 2-49.
   - One documented incident of transmission of the vaccine virus.

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Who should receive influenza vaccine?

- In 2011, the Advisory Committee on Immunization practices recommends the vaccine for all persons aged 6 months or older.
- Health care workers should be vaccinated for influenza
- Women who will be pregnant curing influenza season (using inactivated vaccine)

Additional Information:

- Children aged 6 months through 8 years require 2 doses of influenza vaccine administered a minimum of 4 weeks apart during their first season of vaccination to optimize immune response.
- TIV preparations, (with the exception of Fluzone Intradermal , Sanofi Pasteur), should be administered intramuscularly.
- For adults and older children, the deltoid is the preferred site. Infants and younger children should be vaccinated in the anterolateral thigh.
- One manufacturer produces a high dose vaccine that is available as an alternative TIV for persons aged ≥65 years.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Who should not receive influenza vaccine:

- Persons with prior severe allergic reaction to influenza vaccine
- Persons who report having had reactions to egg involving angioedema, respiratory distress, lightheadedness, or recurrent emesis, or persons who required epinephrine or other emergency medical intervention, particularly those that occurred immediately or within minutes to hours after egg exposure are more likely to have a serious systemic or anaphylactic reaction
- Persons who have developed Gillian-Barre Syndrome after receiving influenza vaccine
- All vaccines should be administered in settings in which personnel and equipment for rapid recognition and treatment of anaphylaxis are available.

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Non-medication methods to reduce influenza transmission:

- Hand hygiene
- Use of respiratory hygiene cough etiquette reduces environmental contamination with respiratory droplets
- Provide respiratory hygiene supplies and post signs with instructions
- Standard and droplet precautions
- Environmental cleaning and disinfection to reduce fomite transmission
- Furlough employees with influenza for 5 days after diagnosis or duration of illness whichever is longer.
- Separate patients with respiratory illness from others and implement droplet precautions to the extent possible until the patient is evaluated and decision made about patient management
- Restrict visitors with respiratory illness

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Vaccination of your health care workers for influenza:

Will reduce illness and absenteeism

Reduce transmission of influenza from employees to vulnerable populations

Offer vaccination to employees at convenient times and locations.

For employees who "never get the flu" consider the risk of transmission from those with asymptomatic infection .

When people state "I always get sick when I get a flu shot" consider that at the time of year influenza vaccine is given there are often various respiratory viruses in circulation.

The flu shot (injectable vaccine) does not contain active virus particles and will not cause the flu.

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

Reducing infection related morbidity and mortality:

Risk assessment for infection and transmission risks

Comprehensive infection control plan

Exposure control plan

Sanitary environment

Adequate sterilization and disinfection procedures

Standard and transmission based precautions

Surveillance for infections

Process improvement, compliance monitoring

Education of employees and patients

Infection Control Concepts for the ASC
Preventing Infection Related Morbidity and Mortality

QUESTIONS?

Useful Resources

HICPAC publications page:
http://www.cdc.gov/hicpac/pubs.html

CDC Isolation Guidelines:
http://www.cdc.gov/hicpac/pdf/isolation/Isolation2007.pdf

Appendix A :
http://www.cdc.gov/hicpac/2007IP/2007ip_appendA.html

Safely donning and removing PPE:
http://www.cdc.gov/hicpac/2007IP/2007ip_fig.html

EPA registered disinfectant lists:
http://www.epa.gov/oppad001/list_h_mrsa_vre.pdf
http://www.epa.gov/oppad001/list_b_tuberculocide.pdf

Mixing 5000 ppm bleach solution:
http://activatebleach.com/docs/LINK_LIBRARY_Understanding_Bleach_Dilution_Rates.pdf

Infection Control Concepts for the ASC
Preventing Infection Related Morbidity and Mortality

Referenrces:

CDC: Pink Book, Epidemiology and Prevention of Vaccine Preventable Diseases , 12th edition; Chapter 11, Influenza
http://www.cdc.gov/vaccines/pubs/pinkbook/pink-chapters.htm

CDC: Guideline for prevention of Surgical Site Infection, 1999

CDC: Management of Multi-drug Resistant organisms in Health Care Settings, 2006

CDC: Prevention and Control of Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2011

CDC: Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007

Infection Control Concepts for the ASC Preventing Infection Related Morbidity and Mortality

APIC Text of Infection Control and Epidemiology: 3rd edition 2009

Chapter 14-Microbial Pathogenicity and Host Defenses

Chapter 23-Surgical Site Infection

Chapter 45-Surgical Services

Chapter 49-Ambulatory Care

Chapter 70-Staphylococci

Chapter 76- Clostridium difficile Infection and Pseudomembranous Colitis

Chapter 83- Influenza