Perioperative Management of Multidrug-Resistant Organisms in Health Care Settings

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During the past four decades, the prevalence of multidrug-resistant organisms (MDROs) and the incidence of MDRO infections have increased steadily in US hospitals, creating an increased risk to patients, including surgical patients. Significantly problematic MDROs include

- methicillin-resistant *Staphylococcus aureus* (MRSA);
- vancomycin-resistant Enterococci (VRE); and
- extended-spectrum beta-lactamase gram-negative bacilli such as *Klebsiella, Escherichia coli,* and *Pseudomonas.*

These MDROs cause infections that are difficult and expensive to treat, resulting in increased morbidity and mortality rates and longer hospital stays.

Surgical patients are at very high risk for health care-associated MDRO infections. Engemann et al reviewed the records of 479 patients to assess the effect of methicillin resistance on the outcomes of patients with surgical site infections (SSIs) caused by *Staphylococcus aureus.* Their study concluded that MRSA SSIs are independently associated with increased mortality rates and hospital charges for patients with these infections. Additionally, Carmeli et al reported that patients with wound or abdominal infections caused by VRE were more likely to require surgery than patients without VRE infections. Thus, patients colonized or infected with an MDRO may be at increased risk of requiring surgery in addition to other adverse health care-associated consequences.

In October 2006, the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC) published *Management of Multidrug-Resistant Organisms in Healthcare Settings,* a long-awaited national guideline for preventing and controlling MDRO infections. These guidelines are designed to direct the implementation of strategies to prevent cross transmission of MDRO infections. The guidelines provide not only general recommendations for routine prevention and control of MDROs, but also additional measures called

**ABSTRACT**

GUIDELINES FOR MANAGING multidrug-resistant organisms (MDROs) in health care settings were published by the Healthcare Infection Control Practices Advisory Committee (HICPAC) in October 2006.

THESE GUIDELINES OUTLINE appropriate strategies to help prevent MDRO cross transmission. Perioperative nurses should be prepared to implement these strategies in an effort to protect their surgical patients from contracting MDRO infections.

THE HICPAC RECOMMENDS elevating contact precautions to “intensified interventions” in facilities with endemic outbreaks of MDROs. Perioperative nurses should participate in these efforts by adhering to infection control practices, championing these practices with other health care personnel, and providing clinical support and leadership. AORN J 86 (September 2007) 361-368. © AORN, Inc, 2007.
“intensified interventions” that may be initiated when the prevalence of MDROs or incidence of MDRO infections is increasing. They encourage health care facility leaders to ensure that appropriate strategies are implemented fully, evaluated for effectiveness, and adjusted to ensure a consistent decrease in the prevalence of targeted MDROs.

This article provides a brief overview of the HICPAC guidelines as they relate to perioperative nursing and the prevention of infections associated with surgery. The first tier of these recommendations addresses routine prevention and control of MDROs. The second tier of recommendations is geared toward intensified MDRO control efforts. These control efforts are interventions that are instituted when prevalence of MDROs or the incidence of MDRO infections is not decreasing despite the use of routine control measures. This article also reviews recommendations that apply to perioperative nursing and that support excellence in perioperative care.

**General Recommendations**

The HICPAC recommendations for administrative measures include making the prevention of MDRO infections a priority as an organizational patient safety goal and providing both fiscal and human resource support to prevent and control MDRO transmission. Human resource support should be evidenced by allocation of resources (eg, adequate staffing) to implement a successful MDRO prevention program. An effective MDRO prevention program should include

- an effective infection control education program,
- an innovative hand-hygiene program,
- appropriate use of standard and contact precautions,
- easy accessibility to and constant availability of personal protective equipment (PPE), and
- an aggressive environmental and equipment cleaning and disinfection program.

**Infection control education.** The HICPAC guidelines emphasize the importance of educating health care workers about the risks and prevention of MDRO transmission. In addition to basic infection control principles (eg, hand hygiene, respiratory etiquette, isolation precautions), education should include the epidemiology of MDROs specific to the facility and actions that can be taken to prevent transmission. Educational updates should provide information to all health care workers on the effectiveness of strategies implemented to reduce rates of MDRO infections.

**Hand hygiene.** Effective hand hygiene has been identified as the most important aspect of an infection prevention program. The Joint Commission has established hand hygiene as a patient safety standard and recommends that facilities have evidence of an effective hand-hygiene program. The hand hygiene patient safety standard requires that hand hygiene compliance be monitored and that compliance rates be provided to health care workers. Two suggestions for measuring improvements in hand-hygiene adherence are

- monitoring and recording adherence reported as the number of hand-hygiene episodes performed by personnel divided by the number of hand-hygiene opportunities and
- monitoring the volume of alcohol-based product used per 1,000 patient days.

Managers and directors of perioperative departments in health care facilities should ensure appropriate access to sinks, antimicrobial soaps, surgical scrubs, waterless alcohol-based hand sanitizers, and lotions.
hand sanitizers, and lotions.4,6,7 They should request feedback on hand-hygiene adherence from the infection control practitioner if this is not readily available.

**STANDARD AND CONTACT PRECAUTIONS.** Standard precautions and contact precautions are commonly accepted infection control practices that have been adopted throughout the United States to control transmission of all pathogens, including MDROs.4 Policies and procedures should define the application of standard precautions and contact precautions in each facility. Standard precautions require that PPE, including gloves, gowns, and face shields, be used appropriately during all patient encounters to protect health care workers from exposure to body fluids, which may be infected with pathogens.4,9 Contact precautions are recommended for all patients known to be colonized or infected with specified MDROs.1 Use of contact precautions helps minimize concern for cross transmission of an MDRO via the environment or equipment.

Contact precautions help prevent cross transmission from both direct contact with the patient and indirect contact with contaminated environmental surfaces. Important components of contact precautions when caring for a patient with an MDRO infection include

- placing the patient in a private room or co-horting the patient with a patient who has the same MDRO,
- limiting patient movement and transport except for essential purposes,
- wearing gowns and gloves when entering the patient’s room, and
- dedicating noncritical patient care equipment to a single patient whenever possible.4

Variations in application of contact precaution policies exist between health care facilities based on the type of pathogen that is either colonized in a patient or actually causing an infection.

Infection control approaches targeted to prevent and control MDRO infections may vary greatly among health care facilities across the nation. More than 10 years ago, the CDC published the *Guideline for Isolation Precautions in Hospitals* that recommended using both standard and contact precautions for the prevention and control of MDROs.5 The CDC recently released the first major revision to its 1996 isolation guideline, the *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings 2007*, which updates and replaces the 1996 guideline.6 This revision reflects current infection-control concerns associated with the changes that have occurred in health care delivery. Revisions identified by evidence-based research and observations during occurrence of outbreaks were recommended, including

- promoting respiratory cough/hygiene etiquette and wearing fit-tested N95 or higher respirators;
- improving current safe infection practices in all settings;
- donning gowns, gloves, and masks upon entry into the room of a patient who is subject to contact and/or droplet precautions; and
- developing a new definition of epidemiologically important organisms.6

**ACCESSIBILITY AND AVAILABILITY OF PPE.** Appropriate PPE (eg, gowns, gloves, barrier masks with face shields, aprons) should be readily available in all clinical settings at all times—for instance, in case a patient develops explosive diarrhea of an unknown etiology. Gowns and gloves should be immediately available and worn to protect the health care workers’
The Healthcare Infection Control Practices Advisory Committee identified an elevated level or second tier of contact precautions called “intensified interventions” to be used when a facility has endemic levels of multidrug-resistant organism (MDRO) colonization or outbreaks of MDRO infections.

INTENSIFIED INFECTION CONTROL MEASURES

The HICPAC guideline also presents an elevated level or second tier of contact precautions called “intensified interventions,” which may be used in facilities that have endemic levels of MDRO colonization or outbreaks of MDRO infections. Optimal strategies for the control of MDROs remain under debate and should be based on assessments of appropriate local facility personnel such as members of the infection control program. The HICPAC recommends, therefore, that individual facilities adopt effective measures that fit their circumstances and needs.

It is important for perioperative nurses to understand the prevalence of targeted MDROs that are causing infections in their facility and the reason for the level of infection control measures adopted. If the prevalence of MRSA or any other targeted MDRO increases, the HICPAC recommends that intensified interventions be implemented. These measures include:

- increasing the frequency of education for health care workers that is adapted specifically to the prevalence of the targeted MDRO unique to that unit and type of infection,
- implementing molecular typing,
- implementing protocols to obtain active surveillance cultures from patients at risk and to isolate colonized as well as infected patients, and
- enhancing education of environmental staff members and intensifying cleaning and disinfecting protocols.

When the first case or outbreak of an epidemiologically important MDRO is identified through surveillance activities, infection control practitioners should inform health care workers and administrators of the findings and the implementation of intensified interventions. The frequency of MDRO educational programs should be increased. The infection control practitioner may choose to implement molecular typing, which is a process of matching DNA types of targeted MDROs by pulse-gel electrophoresis in order to document transmission from person to person or via the environment. The infection control practitioner also may decide to obtain surveillance cultures.
for the pathogen causing increased infections in the population at risk, which frequently includes patients in the surgical and intensive care units. The infection control practitioner or physician may determine that areas of skin breakdown and draining wounds should be cultured. Surveillance cultures may be obtained on admission and at specified intervals to identify colonized, asymptomatic patients and to determine if transmission has decreased after interventions. Taking these cultures often is referred to as active surveillance.

An increased number of patients for whom contact precautions apply can be expected during a period of intensified interventions. Patients who are colonized with an MDRO and patients who are infected may be subject to contact precautions until the surveillance cultures are reported negative for the identified MDRO.

Patients with an MDRO should be placed in a private room or cohorted with patients who have the same MDRO colonization or infection. In some cases, when transmission continues despite adherence to designated isolation precautions, nursing and ancillary service staff members may be dedicated to provide care for the patients who are colonized or infected. Managers and infection control practitioners must strictly enforce compliance with contact precautions.

Environmental measures also must be enhanced during intensified infection control measures. Before assigning environmental staff members to work in areas targeted for intensified MDRO control, perioperative managers should ensure that the staff members have undergone appropriate training to work in those areas. Cleaning performance should be supervised and inspected to ensure that high-touch areas are cleaned and disinfected at least daily as well as when visibly soiled. Hospital cleaner/disinfectants should be EPA-approved and should be selected based on the microbiology and susceptibility of the pathogen. Environmental cultures may be collected to determine association of the environment with ongoing transmission of targeted MDROs.

The judicious use of antimicrobials to determine a potential cause must be evaluated when the incidence of an MDRO increases. Control and improved selection of antimicrobials may be directed by clinical leadership.

**Applications to Perioperative Nursing**

Knowledge of MDRO trends and prevention practices in the facility are essential to protect patients and employees from cross transmission. Perioperative nurses can observe and provide feedback to other members of the perioperative health care team on perioperative team member compliance with infection control and prevention practices. Assuming personal responsibility for the implementation of facility MDRO control practices is essential. Consistency in the practice of hand hygiene, isolation precautions, and environmental disinfection should be every perioperative nurses’ priority.

Appropriate selection and timely administration of preoperative antibiotics is essential in the prevention of potential SSIs, including those caused by MDROs. In some cases, it may be advisable to schedule a patient who is colonized or infected with an MDRO as the last procedure of the day to decrease risk of
Whether or not a patient is colonized or infected with a multidrug-resistant organism, perioperative personnel should not wear gowns and gloves out of a specific OR to other areas of the operating suite such as the sterile core or internal hallways because of the risk of transmitting an organism.

cross transmission in the holding area and in the postanesthesia care unit (PACU). All equipment, including stethoscopes and other monitoring equipment, should be cleaned and disinfected immediately after use and before use on another patient.

Perioperative nurses must be aware that the reason for wearing gloves, gowns, and masks may be to protect others from cross transmission, as well as to prevent exposure of the surgical patient to pathogens. All perioperative personnel must use PPE that has been approved for use with contact precautions and change PPE between patient contacts. After the patient contact, correct hand hygiene should be performed. Personal protective equipment should never be worn outside of the OR where a procedure is being performed.

Often, perioperative personnel believe that PPE is worn only to protect the patient from organisms that the health care worker carries (ie, direct inoculation). Personnel must make a paradigm shift to remember that PPE also is used in the OR to prevent cross transmission of the MDRO between one patient and another or the environment (ie, indirect inoculation). Whether or not a patient is colonized or infected with an MDRO, perioperative personnel should not wear gowns and gloves out of the specific OR to other areas of the operating suite such as the sterile core or internal hallways because of the risk of transmitting an MDRO. Under intensified measures, patients who are colonized or infected with an MDRO should be managed with contact precautions throughout the perioperative experience, including in the PACU. Again, the importance of communicating about the need for isolation arises.

Beyea suggested that perioperative nurses must remember how their infection control practices influence their surgical clinical practice and, in doing so, raise the bar to reduce infections by making prevention a top patient safety priority. She recognized perioperative nurses as the first line of defense for surgical patients each time they intervene to minimize infection risks. These activities would include preventing cross transmission of MDROs through hand hygiene, standard precautions, contact precautions, and other intensified measures. Ott et al identified the increasing prevalence of MRSA as a global issue and explored methods for effective control in hospital settings. They recommended the following measures as essential to prevention of MRSA transmission:

- maintaining good hand hygiene practice,
- wearing gloves and gowns when appropriate,
- maintaining a clean hospital environment,
- isolating patients who are colonized or infected with MRSA, and
- providing reassurance with a positive attitude to isolated patients and their family members to help relieve anxiety and to instill confidence.

Infection control professionals should be available to respond to requests for MDRO consults immediately and must provide accurate and appropriate clinical answers. A multidisciplinary process should be established to monitor and improve health care personnel adherence to hand hygiene and standard and contact precautions. Communication systems must be designed to designate patients known to be colonized or infected with an MDRO and used to relay this status between

366 • AORN JOURNAL
transferring and receiving personnel in different sections of the health care facility. These systems may be implemented with verbal reports and/or through computerized alerts that flag the medical records of patients with MDRO infections. The HICPAC MDRO guidelines also address the responsibility of providing updated feedback to health care providers and administrators regarding facility and unit trends in MDRO infections as a measure of program effectiveness.

A perioperative nurse should be a member of the multidisciplinary team assigned to champion, monitor, and improve adherence to hand hygiene and standard and contact precautions. It is essential that the entire process of providing care to a patient who is colonized or infected with an MDRO be addressed in multidisciplinary meetings. Patients with MDROs frequently are sent to surgery with infections such as a draining wound or infected hardware. The process of preventing cross transmission of the MDRO must be addressed in all perioperative settings including the surgical ward, the holding area, the surgery suite, and the PACU. As a member of the infection control interdisciplinary team, the perioperative nurse can advocate for the importance of communicating the presence of an MDRO between sending and receiving units during hand-off communications. The perioperative nurse is instrumental in designing an effective mechanism for communicating with transferring units regarding infection status of a patient. Another role that the perioperative nurse can assume is champion of prevention programs that are designed to decrease the prevalence or incidence of MDRO infections.

Infection control programs are strengthened by expert liaisons in clinical areas who can educate staff members on clinical strategies targeted to decrease the incidence of MDRO infections. As a part of this communication, it is useful to share the trends in surgical site infections, catheter-related bloodstream infections, and ventilator-acquired pneumonias, particularly those caused by MDROs. Giving feedback to staff members by displaying quality improvement graphs and sharing of performance findings has been shown to be highly effective in performance improvement. Having a perioperative nurse participate in this multidisciplinary endeavor is invaluable in meeting the administrative and education components of the HICPAC MDRO guideline.

**CONCLUSION**

Infection control practitioners should direct and guide intensified surveillance with strong support from facility leaders. Perioperative nurses are essential in the success of intensified measures through daily direction and modeling of patient safety practices in the clinical setting. Consistently practicing safe infection control principles, championing these practices with others, and providing clinical support and leadership during periods of increased incidence of targeted MDROs are all essential practices that will help prevent and control MDROs in the perioperative setting.

**REFERENCES**


Anaheim Information Available for Congress 2008 Attendees

Congress 2008 will take place in Anaheim, California, from March 30 to April 3, 2008, and attendees and exhibitors may want to take some extra time before or after Congress to enjoy the local attractions. Anaheim has numerous theme parks, theaters, art galleries, markets, and shopping opportunities for interested visitors—but many visitors may not know where to go to find what they are looking for.

AORN, in conjunction with the Anaheim/Orange County Visitor & Convention Bureau, has created a special web site you can use to search for things to see and do in Anaheim before or after Congress. Whether you want to • get driving directions and maps, • find parking, • research restaurants, • check out the theme parks, • view airport and transportation information, • take a look at special events and attractions, or • find out what the weather will be like, there is something on this web site for you. To access the web site, go to http://anaheimoc.org/microsites/sites/AORN.asp.

Questionnaire May Predict Risk for Chronic Kidney Disease

Researchers have developed a simple questionnaire to identify patients at risk for chronic kidney disease, according to a February 26, 2007, news release from Weill Cornell Medical College of Cornell University, New York, NY. Patients with chronic kidney disease can be identified early in the disease process if they are tested, but many patients do not find out that they have the disease until it has progressed to end-stage kidney disease. Current practice guidelines suggest testing for increased creatinine levels and glomerular filtration rates in patients who are 18 years of age or older and who have a family history of diabetes or hypertension. This approach, however, focuses on single factors and does not quantify the cumulative effects of multiple risk factors.

Using statistical modeling and validation, researchers were able to determine that only seven factors had significant association with increased risk of chronic kidney disease. These factors—age, female gender, hypertension, diabetes, cardiovascular disease, proteinuria, anemia—frequently occur together and cumulatively affect kidney function.

Researchers recommend giving patients a simple questionnaire that identifies the presence of factors associated with kidney disease. If the patient has a score of four or higher, his or her creatinine levels and/or glomerular filtration rates should be tested. If the tests show that the patient has early-stage kidney disease, he or she could be started on treatment that might significantly delay the progression to end-stage kidney disease and lessen the cardiovascular complications that sometimes occur with chronic kidney disease.

Researchers Develop Simple Model and Questionnaire for Predicting Chronic Kidney Disease [news release]. New York, NY; Weill Cornell Medical College; February 26, 2007.
Perioperative Management of Multidrug-Resistant Organisms in Health Care Settings

Purpose/Goal
To educate perioperative nurses about management of multidrug-resistant organisms (MDROs) in health care settings.

Behavioral Objectives
After reading and studying the article on MDROs, nurses will be able to

1. describe how colonization or infection with significantly problematic MDROs may affect a patient’s hospital course,
2. discuss the Healthcare Infection Control Practices Advisory Committee recommendations for the management of MDROs in health care settings,
3. identify intensified infection control measures, and
4. explain how facility MDRO control practices are implemented in the perioperative environment.

Questions

1. Research studies indicate that compared to patients without MDRO infections, patients colonized or infected with an MDRO may
   a. be at an increased risk of adverse health care-associated consequences.
   b. be at an increased risk of requiring surgery.
   c. have an increased mortality rate.
   d. have higher hospital charges.
a. 1 and 3  
b. 2 and 4  
c. 1, 2, and 4  
d. 1, 2, 3, and 4

2. An effective MDRO prevention program should include
   a. an aggressive environmental and equipment cleaning and disinfection program.
   b. an effective infection control education program.
   c. an innovative hand-hygiene program.
   d. appropriate use of standard and contact precautions.
   e. easy accessibility to and constant availability of personal protective equipment (PPE).
a. 1 and 3  
b. 2 and 4  
c. 1, 2, and 4  
d. 1, 2, 3, and 4

3. The most important aspect of an infection prevention program is effective hand hygiene.
a. true  
b. false

4. Important components of contact precautions when caring for a patient with an MDRO infection include
   a. dedicating patient equipment for single-patient use whenever possible.
   b. limiting patient movement and transport to essential purposes.
   c. putting a gown and gloves on the patient when he or she leaves the isolation room.
   d. placing the patient in a private room or cohorting the patient with a patient who has the same MDRO.
   e. wearing a gown and gloves when entering the patient’s room.
a. 1 and 3  
b. 2, 4, and 5
5. Disposable disinfectant wipes are an effective supplemental product for cleaning hospital equipment and furniture.  
   a. true  
   b. false

6. To determine whether a targeted MDRO was transmitted from person to person or via the environment, an infection control practitioner may implement  
   a. antibody screening.  
   b. molecular typing.  
   c. serum complement assays.  
   d. sequestration.

7. Taking cultures on admission and at specified intervals to identify colonized, asymptomatic patients and to determine if transmission has decreased after interventions often is referred to as  
   a. focused surveillance.  
   b. targeted surveillance.  
   c. active surveillance.  
   d. passive surveillance.

8. Infection control practices that are applicable to the perioperative environment to prevent MDRO infections include  
   1. appropriate selection and timely administration of preoperative antibiotics.  
   2. scheduling patients who are colonized or infected with an MDRO as the last procedure of the day, if necessary.  
   3. cleaning and disinfecting all equipment immediately after use and before use on another patient.  
   4. ensuring use of PPE that has been approved for contact precautions and changing PPE between patient contacts.  
   5. performing correct hand hygiene after patient contact.  
   6. never wearing PPE outside of the OR where the procedure is being performed.  
   a. 1, 3, and 5  
   b. 2, 4 and 6  
   c. 1, 2, 3, 4, and 5  
   d. 1, 2, 3, 4, 5, and 6

9. Perioperative personnel wear PPE to prevent cross transmission of an MDRO between one patient and another or the environment, which is called  
   a. direct inoculation.  
   b. indirect inoculation.  
   c. direct contamination.  
   d. indirect contamination.

10. Systems to communicate the status of patients known to be colonized or infected with an MDRO between transferring and receiving personnel in different sections of the health care facility may include  
   1. verbal reports.  
   2. computerized alerts that flag the medical records of patients with MDRO infections.  
   3. name wrist bands to identify that the patient is in isolation.  
   a. 1  
   b. 1 and 2  
   c. 2 and 3  
   d. 1, 2, and 3
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Learner Evaluation

Perioperative Management of Multidrug-Resistant Organisms in Health Care Settings

This evaluation is used to determine the extent to which this continuing education program met your learning needs. Rate these items on a scale of 1 to 5.

PURPOSE/GOAL
To educate perioperative nurses about management of multidrug-resistant organisms (MDROs) in health care settings.

OBJECTIVES
To what extent were the following objectives of this continuing education program achieved?
1. Describe how colonization or infection with significantly problematic MDROs may affect a patient’s hospital course.
2. Discuss the Healthcare Infection Control Practices Advisory Committee recommendations for the management of MDROs in health care settings.
3. Identify intensified infection control measures.
4. Explain how facility MDRO control practices are implemented in the perioperative environment.

CONTENT
To what extent
5. did this article increase your knowledge of the subject matter?
6. was the content clear and organized?
7. did this article facilitate learning?
8. were your individual objectives met?
9. did the objectives relate to the overall purpose/goal?

TEST QUESTIONS/ANSWERS
To what extent
10. were they reflective of the content?
11. were they easy to understand?
12. did they address important points?

LEARNER INPUT
13. Will you be able to use the information from this article in your work setting?
   a. yes
   b. no
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   c. the AORN Journal web site.

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