Chelonian Conservation And Biology

Vol. 18 No. 2 (2023) | https://www.acgpublishing.com/ | ISSN - 1071-8443

DOI: doi.org/10.18011/2023.12(2).2727.2742

HOSPITAL ACQUIRED INFECTIONS. A SCIENTIFIC REVIEW OF EVIDENCE BASED RECOMMENDATIONS.

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Abstract

Hospital-acquired infections can increase the rate of morbidity and mortality as well as medical costs. Nosocomial infection is spread in various ways, such as surgical, intravenous catheters, surface contact (like hands), and also through the air. Some interventions, including appropriate hand and surface decontamination, sufficient staffing, improved ventilator management, and the use of coated central venous and urinary catheters, have all been linked with a considerably lower rate of nosocomial infection. Multiple interventions simultaneously are required for comprehensive infection control, and multiple actions may have a better outcome than a single action. Some multiple infection control protocols will possibly show a more effective result than employing a single or few strategies. Several non-pharmacological interventions to prevent HAIs will reduce the requirement for prolonged or multiple-drug antibiotic courses for infected patients. And lower antibiotic usage will decrease the risk of antibiotic-resistant organisms and may improve the effectiveness of antibiotic therapy for patients with acquired infections.

Keywords: hospital-acquired infection, health-care-associated infection,nosocomial infection, infection control, hand washing,

Introduction

Hospital-acquired infections (HAIs) are a major safety concern for both health care providers and patients. Considering morbidity, mortality, increased length of stay, and cost, efforts should be made to make hospitals as safe as possible by preventing such infections. These guidelines have been developed for health care personnel involved in patient care in wards and critical care areas and for persons responsible for surveillance and control of infections in hospitals [1].

The principles of the grading of recommendations assessment, development, and evaluation (GRADE) system are used to guide the assessment of the quality of evidence from high (A) to very low (C) and to determine the strength of recommendations. Each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and economic impact. The GRADE system classifies recommendations as strong (grade 1) or weak (grade 2) [2]. The assignment of strong or weak evidence is considered of greater clinical importance than a difference in the level of quality of the evidence.

The system for categorizing recommendations in this guideline is as follows:.

Level of evidence

Evidence from at least one properly designed randomized, controlled trial

Evidence from at least one well-designed clinically controlled analytic study (preferably from more than one center), multiple time-series studies, or dramatic results from uncontrolled experiments

Evidence from the opinions of respected authorities based on clinical experience, descriptive studies, or reports of experts. [3]

Strength of recommendation

Strong (we recommend)

Weak (we suggest).

General Measures of Infection Control

Isolation

Screen all intensive care unit (ICU) patients for the following:

Neutropenia and immunological disorders

Diarrhea

Skin rashes

Known communicable disease

Identify the type of isolation needed. There are two types of isolation in the ICU:

Protective isolation for neutropenic or other immunocompromised patients to reduce the chances of acquiring opportunistic infections

Source isolation of colonized or infected patients to minimize potential transmission to other patients

Isolation rooms should have tight-fitting doors, glass partitions for observation, and both negative-pressure (for source isolation) and positive-pressure (for protective isolation) ventilations.

Patients at risk of nosocomial infections

There are patient-, therapy-, and environment-related risk factors for the development of nosocomial infections. [3]

Age more than 70 years

Shock

Major trauma

Acute renal failure

Coma

Prior antibiotics

Mechanical ventilation

Drugs affecting the immune system (steroids, chemotherapy)

Indwelling catheters

Prolonged ICU stay (>3 days).

Observe hand hygiene.

Hands are the most common vehicle for the transmission of organisms, and “hand hygiene” is the single most effective means of preventing the horizontal transmission of infections among hospital patients and health care personnel. [4]

When and why: follow the World Health Organization's (WHO’s) five moments for hand hygiene [Image 1]

Image 1.

Before touching a patient , protect the patient from harmful germs carried on your hands.

Before aseptic procedures: to protect the patient against harmful germs, including the patient's own germs

After body fluid exposure or risk, protect yourself and the health care environment from the harmful patient's germs.Remember, there are two moments before and three moments after touching the patient.

How

Wash hands with soap and water when they are soiled or visibly dirty with blood or other body fluids. Wet your hands, apply soap, and then scrub them vigorously for at least 15 seconds. Cover all surfaces of the hands and fingers, wash with water, and then dry thoroughly using a disposable towel.

Use an alcohol-based hand rub, e.g., 0.5% chlorhexidine with 70% w/v ethanol, if your hands are not visibly dirty. A combination of chlorhexidine and alcohol is ideal, as they cover gram-positive and gram-negative organisms, viruses, mycobacteria, and fungi. Chlorhexidine also has residual activity.

During surgical hand preparation, all hand Jewelry (e.g., rings, watches, and bracelets) must be removed.

Finger nails should be trimmed to <0.5 cm with no nail polish or artificial nails.

Avoid wearing long sleeves; ties should be tucked in; house coats are discouraged; Follow standard precautions.

Standard precautions include prudent preventive measures to be used at all times, regardless of a patient's infection status. [5]

Gloves

Sterile gloves should be worn after hand hygiene procedures while touching mucous membranes and non-intact skin and performing sterile procedures, e.g., arterial, central line, and Foley catheter insertion.

Clean, non-sterile gloves are safe for touching blood, other body fluids, contaminated items, and any other potentially infectious materials.

Change gloves between tasks and procedures for the same patient, especially when moving from a contaminated body area to a clean body area.

Never wear the same pair of gloves for the care of more than one patient.

Remove gloves after caring for a patient.

Gown

Wear a gown to prevent soiling of clothing and skin during procedures that are likely to generate splashes of blood, body fluids, secretions, or excretions.

The sterile gown is required only for aseptic procedures, and for the rest, a clean, non-sterile gown is sufficient.

Mask, eye protection, or face shield

Wear a mask and adequate eye protection (eyeglasses are not enough) or a face shield to protect mucous membranes of the eyes, nose, and mouth during procedures and patient care activities that are likely to generate splashes or sprays of blood and body fluids.

Patients, relatives, and health care workers (HCWs) presenting with respiratory symptoms should also use masks (e.g., cough) [6].

Patient-care equipment

Used patient-care equipment soiled with blood, body fluids, secretions, or excretions should be handled carefully to prevent skin and mucous membrane exposures, contamination of clothing, and the transfer of microorganisms to HCWs, other patients, or the environment.

Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and sterilized appropriately.

Ensure that single-use items and sharps are discarded properly.

Follow transmission-based precautions.

In addition to standard precautions, the following should be observed in those patients known or suspected to have airborne, contact, or droplet infections:

Airborne precautions

Disease-causing microorganisms may be suspended in the air as small particles, aerosols, or dust and remain infective over time and distance; for example, Mycobacterium tuberculosis (pulmonary/laryngeal), Varicella zoster virus (chickenpox), Herpes zoster (shingles), Rubella virus, and measles.

Isolate with negative-pressure ventilation

Respiratory protection must be employed when entering the isolation room.

Use the disposable N-95 respirator mask, which fits tightly around the nose and mouth, to protect against both large and small This should be worn by all people entering the room, including visitors [7].

Contact precautions

Infections can be spread by direct or indirect contact with an infected person, the surfaces, or patient care items in the room; for example, parainfluenza virus infection, respiratory syncytial virus infection, varicella (chickenpox), herpes zoster, hepatitis A, and rotavirus infection. [4]

Isolation is required.

Non-critical patient care equipment should preferably be of single If unavoidable, then clean and disinfect them adequately before using them on another patient.

Limit the transport of the patient.

Droplet precautions

Microorganisms are also transmitted by droplets (large particles >5 μm in size) generated during coughing, sneezing, talking, or short-distance travel, for example, influenza virus, Bordetella pertussis, Hemophilus influenzae (meningitis, pneumonia), Neisseria meningitidis (meningitis, pneumonia, and bacteremia), Mycoplasma pneumoniae, severe acute respiratory syndrome-associated coronavirus, Group A Streptococcus, adenovirus, and rhinovirus [8].

Respiratory protection must be employed when entering the isolation room or within 6–10 feet of the patient. Use the disposable N-95 respirator mask, which fits tightly around the nose and mouth, to be observed in those patients known or suspected to have airborne, contact, or droplet infections. [9]

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Respiratory protection must be employed when entering the isolation room.

Use the disposable N-95 respirator mask, which fits tightly around the nose and mouth, to protect against both large and small This should be worn by all people entering the room, including visitors [10].

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Infections can be spread by direct or indirect contact with an infected person, the surfaces, or patient care items in the room; for example, parainfluenza virus infection, respiratory syncytial virus infection, varicella (chickenpox), herpes zoster, hepatitis A, and rotavirus infection. [11]

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Isolation is required.

Respiratory protection must be employed when entering the isolation room or within 6–10 feet of the disposable N-95 respirator mask, which fits tightly around the nose and mouth to site, replace it with an upper extremity site as soon as possible.

Use maximal sterile barrier precautions (cap, mask, sterile gown, and sterile gloves) and a sterile full-body drape while inserting CVCs, peripherally inserted central catheters, or guidewire exchange.

Cleanse the skin with more than 5% chlorhexidine.

preparation with alcohol (usually 2% chlorhexidine with 70% w/v ethanol) before CVC, arterial catheter insertion, etc.

Use chlorhexidine/silver sulfadiazine or minocycline/rifampin-impregnated CVCs when the catheter is expected to remain in place for more than 5 days and only if the bloodstream infection rates are high in the unit despite successful implementation of measures to reduce CRBSI.

Use ultrasound-guided insertion if technology and expertise are available

Use either sterile gauze or a sterile, transparent, semipermeable dressing to cover the catheter site (IA). Replace the catheter site dressing only when the dressing becomes damp, loosened, or visibly soiled.

Evaluate the catheter insertion site daily and check if

A transparent dressing is present, and palpate through the dressing for any tenderness.

Insertion dates should be put on all vascular access devices.

Use a 2% chlorhexidine wash daily for skin cleansing to reduce CRBSI.

Use needleless intravascular catheter access systems and avoid closed catheter access systems, which should be preferred to open systems.

Clean injection ports with an appropriate

antiseptic (chlorhexidine, povidone-iodine, an iodophor, or 70% alcohol), accessing the port only with sterile devices. Cap stopcocks when not in use.

Assess the need for the intravascular catheter daily and remove it when not required.

Peripheral lines should not be replaced more frequently than 72–96. Routine replacement of CVCs is not required.

Replace administration sets, including secondary sets and add-on devices, every day in patients receiving blood, blood products, or fat emulsions.

If other intravenous fluids are used, change at <96-hour intervals and at least every 7 days.

Needleless connectors should be changed frequently (every 72 hours)

Replace disposable or reusable transducers at 96-hour intervals.

Strategies to reduce UTI

Insert catheters only for appropriate indications.[9]

Follow the aseptic insertion of the urinary catheter.

Maintain a closed drainage system.

Maintain unobstructed urine flow. At all times, the urinary catheter should be placed and taped above the thigh, and the urinary bag should hang below the level of the bladder.

The urinary bag should never have floor contact.

Changing indwelling catheters or drainage bags at fixed intervals is not necessary only if there are clinical indications such as infection or obstruction or when the closed system is compromised.

Remove the catheter when it is no longer needed.

Consider environmental factors.

Cleaning and disinfection

High-quality cleaning and disinfection of all patient-care areas is important, especially surfaces close to the patient (e.g., bedrails, bedside tables, doorknobs, and equipment). [10]

Some pathogens can survive for long periods in

the environment, particularly methicillin-resistant Sataphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), Acinetobacter species, Clostridium difficile, and norovirus

EPA-registered disinfectants or detergents that best meet the overall needs of the ICU should be used for routine cleaning and disinfection.

The frequency of cleaning should be as follows: Surface

cleaning (walls) twice weekly, floor cleaning 2-3 times/day, and terminal cleaning (patient bed area) after discharge or death.

Architecture and layout, especially while designing a new ICU

The unit may be situated close to the operating theater and emergency department for easy accessibility, but should be away from the main ward areas [13].

Central air-conditioning systems are designed in such a way that recirculated air must pass through appropriate filters [11].

It is recommended that all air be filtered to 99% efficiency down to 5 μm. [11]

Suitable and safe air quality must be maintained at all times. Air movement should always be from clean to dirty areas [11].

It is recommended to have a minimum of six total air changes per room per hour, with two air changes per hour composed of outside air (1B). [11]

The isolation facility should have both negative- and positive-pressure ventilation. [11]

Clearly demarcated routes of traffic flow through the ICU are required [11].

Adequate space around beds is ideally 5–3 m .

Electricity, air, and vacuum outlets and connections should not hamper access around the bed[11].

An adequate number of washbasins should be installed [11].

Alcohol gel dispensers are required at the ICU entry, exits, every bed space, and every workstation [11].

There should be a separate medication preparation area [11].

There should be separate areas for clean storage and soiled and waste storage and disposal [11].

Adequate toilet facilities should be provided. [11]

Organizational and administrative measures

Work with hospital administration for a better patient-to-nurse ratio in the ICU[4, 12].

Policies for controlling traffic flow to and from the unit to reduce sources of contamination from visitors, staff, and equipment

Waste and sharp disposal policy

Education and training for ICU staff about the prevention of nosocomial infections

ICU protocols for the prevention of nosocomial infections

Audit and surveillance of infections and infection control practices

Infection control team (multidisciplinary approach)

Antibiotic stewardship

Vaccination of health care personnel [13-18]

Recommendations for Antimicrobial Stewardship

Core members of a multidisciplinary antimicrobial stewardship program should include an infectious disease physician and a clinical pharmacist with infectious disease training.

Other members of the team may include a clinical microbiologist, an information system specialist, an infection control professional, and a hospital epidemiologist.

In a resource-limited setting, a physician (hospital-based practitioner preferred) with an interest in infectious disease should lead the program along with the hospital microbiologist.

Close collaboration between the antimicrobial stewardship team, microbiology lab, hospital pharmacy, and infection control team should be maintained.

Involvement of the administration with their buy-in to the program is essential for the success of any stewardship program.

It is desirable that antimicrobial stewardship programs function under the auspices of quality assurance and the patient safety department.

A prospective audit of antimicrobial use with direct interaction and feedback to the prescriber by senior members of the antimicrobial stewardship team can result in reduced inappropriate use of antibiotics.

This is the preferable mode of antimicrobial stewardship in an “open” prescription writing setting.

Formulary restrictions and preauthorization requirements can lead to significant reductions in antimicrobial use.

Formulary restriction may also help in decreasing the nosocomial outbreak of resistant infection

Continuing education of all the stakeholders should be done to provide a foundation of knowledge that will enhance and increase the acceptance of stewardship strategies

Education alone, without active intervention like audits and feedback, does not have a sustained impact on the prescribing behavior of physicians

Guidelines and clinical pathways based on evidence and incorporating local microbiology and resistance patterns can improve antibiotic utilization

There is insufficient data to recommend the routine use of combination therapy to prevent the emergence of resistance

De-escalation of antibiotics once culture results are back is an essential ingredient of any stewardship program and should be practiced

Optimizing antibiotic doses taking into consideration PK/PD characteristics should be universally practiced

As under-dosing may be prevalent in a resource-limited setting, close vigilance on the appropriate dosing and a hospital information system and warning mechanism should be incorporated

An early switch from parenteral to oral antibiotics is highly desirable, especially in resource-limited settings, to decrease the cost of therapy and should be actively implemented (1C).

The decreasing duration of antibiotic use as per clinical guidelines to decrease the cost of therapy, reduce antibiotic consumption, and reduce the side effects of drugs should be actively incorporated into the antibiotic stewardship program

Active use of information technologies such as electronic medical records, hospital information systems, computerized physician order entry, and clinical decision support facilitates the delivery of the stewardship program more effectively.

In a resource-limited setting, an effort should be made to customize the use of existing information technology and use indigenous innovation to utilize the existing resources to achieve a similar objective

Optimal use of a microbiology lab is an essential ingredient of any stewardship program. [19-23]

Conclusion

It is imperative that effective HAI management strategies are implemented in hospitals and that health care workers recognize the importance of their individual role in health care-associated

infection prevention. The success of such strategies will require a cultural shift, emphasizing both institutional and individual accountability, and engagement with guidelines that promote optimal infection control practices and the judicious use of antimicrobials.

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