Isolation Guidelines for Hospitals

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Abstract

Hospitals, and long-term-care facilities (LTCFs) represent a complex group of ever-evolving health care systems that serve persons from all age groups and provide variable levels of care to individuals unable to care for themselves. They provide a unique environment favouring the transmission of infections to indoors. Infection control practices should allow for the fact that these facilities are a home as well as a place of nursing and medical care. Facilities differ considerably, and an effective infection control programme should be designed around the specific needs of the patients as well as available resources.

As the population ages, and technology improves to care for patients with previously fatal conditions, both the number and proportion of patients will increase. Changes in acute care practices are moving more acutely ill persons from hospitals into LTCFs, resulting in changes in both the composition and number of persons in LTCFs.

The incidence of nosocomial infections is increasing and these infections contribute to significant number of deaths. Infections may be sporadic, endemic, or epidemic, and could be transmitted in a variety of ways.

Antibiotic-resistant bacteria are frequently present, and inappropriate antibiotic use appears to be common. Antibiotic-resistant organisms can be easily transmitted. In our country, hospitals often lack adequate infection control programmes and sufficient space for hand washing and isolation of patients. Infection control in these settings is a fascinating mix of hospital and community public health.

Key words: Infection control, Isolation guidelines, Nosocomial.

Introduction

The recognition that infectious agents can be transmitted within hospitals to susceptible patients and health care workers began in the days of Semmelweis, who noted that puerperal fever was associated with the lack of handwashing by physicians performing autopsies. Thus, isolation in various forms has long been used as a means to decrease the likelihood of nosocomial infection.

Methods of isolation to minimise the transmission of infection have varied from the establishment of separate infectious disease and tuberculosis hospitals to “barrier nursing” techniques that utilise gowns, gloves, and masks. Since 1970, the Centers for Disease Control (CDC) have published a series of isolation guidelines for use in hospitals. The guidelines have evolved as our knowledge of the pathogenesis and epidemiology of the important nosocomial pathogens has broadened. The beginning of the AIDS epidemic in 1981 and the subsequent resurgence of tuberculosis in the United States have been the two most important developments shaping the current guidelines.

The acquisition of nosocomial infection is facilitated by:
- Underlying chronic medical illnesses
- Incontinence
- Depressed mental state
- Protracted use of devices such as urinary catheters and nasogastric tubes
- Advanced age
- Factors that promote person-to-person transmission such as crowding and sharing of meals.

Handwashing guidelines

The majority of nosocomial pathogens spread by contact. Thus, handwashing is felt to be the single most effective means of preventing their spread.

- For general use, the Hospital Infection Control Practices Advisory Committee (HICPAC) isolation guidelines recommend plain soap for routine handwashing.
- The use of chlorhexidine-containing agents has been shown to reduce the incidence of nosocomial infections in an intensive care unit (ICU) setting. As an

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example, one prospective crossover trial evaluated 1,894 adult patients in three ICUs over eight months; there were 152 nosocomial infections with chlorhexidine versus 202 with a combination of 60 percent isopropyl alcohol and soap (adjusted incidence-density ratio 0.73 for chlorhexidine)4. Improvement was explained, at least in part, by improved compliance with the handwashing protocol when chlorhexidine was used.

The HICPAC guidelines recommend the use of antimicrobial soaps only for patients in contact isolation or during instances of epidemic or hyperendemic spread of infections. Specific policies are formulated by the Infection Control Committee of individual hospitals from time to time depending on endemicity of infection.

The degree to which the handwashing recommendations are followed was evaluated in an observational study of 2,834 opportunities for handwashing in health care workers5. Overall compliance was 48 per cent. Compliance was highest among nurses and lowest among physicians more in intensive care units than in other settings.

A study from Geneva, Switzerland demonstrated a decrease in nosocomial infection rates and attack rates of methicillin-resistant Staphylococcus infection in one teaching hospital associated with the introduction of a bedside alcohol-based hand disinfectant6. During the study period the use of the hand disinfectant also increased significantly. While overall compliance with hand disinfection increased with the use of the bedside product, physicians as a group remained poor in cleansing hands.

1996 CDC isolation guidelines

The 1996 guidelines include recommendations designed to minimise the risk of occupational exposure (and subsequent transmission to others) to blood and body fluids of patients2.

New standard precautions: The new standard precautions consider all patients and their bodily fluids (except sweat) to be potentially infectious, thereby replacing the old universal precautions which applied only to blood and visibly bloody fluids.

- Gloves are required when hand contact with any of these fluids is anticipated, and hands should be washed after the gloves are removed.

- Impervious gowns must be worn by health care workers to prevent soiling of clothes by splashes of blood or body fluids, and masks along with eye protection are mandated if splashes toward the face are anticipated.

**Additional isolation categories:** In addition to the standard precautions, the new guidelines include three isolation categories based upon the three modes of infection transmission: contact, respiratory droplets, and airborne spread. Contact may occur directly with the source of the microorganism, or indirectly via contamination of the inanimate environment.

- Direct contact includes touching, sexual contact, percutaneous or mucous membrane exposure, or exposure via an infectious vector (e.g., an insect). Organisms that can spread by direct contact include Clostridium difficile, herpes simplex virus (mucocutaneous), scabies, and multidrug-resistant organisms in the gastrointestinal tract, sputum, or wounds.

- Respiratory droplets are large particles expelled during coughing, sneezing, talking, or singing. One study of the transmission of respiratory syncytial virus showed that droplets travel less than six feet from the source patient7. The major organisms spread as respiratory droplets are Haemophilus influenzae type b (invasive), Neisseria meningitidis, Mycoplasma pneumoniae, Bordetella pertussis, influenza virus, and rubella virus.

- Airborne spread depends upon aerosolisation of small particles of the infectious agent that can then travel over long distances through the air. Mycobacterium tuberculosis, varicella-zoster virus, and measles are the most common nosocomial pathogens transmitted by this route. Historically, smallpox was also transmitted by the airborne route, and therefore, it is feared as a potential bioterrorism agent.

The specific infection control measures required to prevent spread through contact, droplet, and airborne route are outlined in Table I. The HICPAC guidelines can be consulted for an exhaustive list of microorganisms and the recommended isolation measures for each infection2. The
CDC has also published guidelines for the prevention of nosocomial tuberculosis (Table II), vancomycin-resistant enterococci (Table III), and the management of patients with viral haemorrhagic fevers (Table IV).

**Table I: Synopsis of recommended infection control measures from the HICPAC guidelines.**

**Contact precautions**
- Private room preferred; cohorting allowed if necessary.
- Gloves required upon entering room. Change gloves after contact with contaminated secretions. Wash hands after removing gloves.
- Gown required if clothing likely to come into contact with the patient or environmental surfaces, or if the patient has diarrhoea.
- Wash hands with antimicrobial soap before leaving the patient’s room.
- Minimise risk of environmental contamination during patient transport (e.g., patient can be placed in a gown).
- Non-critical items should be dedicated for use of a single patient only, if possible.

**Droplet precautions**
- Private room preferred; cohorting allowed if necessary.
- Wear a mask when within 3 feet of the patient.
- Mask the patient during transport.

**Airborne precaution**
- Place the patient in a monitored negative pressure room with at least 6-12 air exchanges per hour.
- Room exhaust must be appropriately discharged outdoors or passed through a HEPA (high-efficiency particulate aerator) filter before recirculation within the hospital.
- A certified respirator must be worn when entering the room of a patient with diagnosed or suspected tuberculosis. Susceptible individuals should not enter the room of patients with confirmed or suspected measles or chickenpox.
- Transport of the patient should be minimised; the patient should be masked if transport within the hospital is unavoidable.
- Stric compliance with respiratory isolation.
- Susceptibility testing of all isolates.
- Early initiation of effective anti-tuberculous chemotherapy.
- Appropriate release of patients from isolation only when no longer infectious.
- Tuberculin skin testing programmes for health-care workers.
- Coordination with public health departments for transition to out-patient therapy and directly observed therapy.

**Engineering controls**
- Monitored rooms at negative pressure to the surrounding areas.
- A minimum of 6 (and preferably 12) air exchanges per hour.
- Exhaust of air to the outdoors or recirculation through HEPA filters before recirculation within the hospital.

**Personal protective equipment**
- NIOSH certified respirators required for health-care workers entering the rooms of suspected or confirmed tuberculosis patients.

**Table II: Synopsis of CDC guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care facilities.**

**Administrative controls**
- Early identification and appropriate isolation of suspected tuberculosis patients.
- Prudent vancomycin use.
- Educational programmes to inform healthcare workers of the epidemiology, clinical relevance, and costs of VRE infection and colonisation.
- Improved detection and reporting of VRE infection and colonisation by the microbiology laboratory. A coordinated effort between the lab and the infection control department is required for surveillance of VRE.
- Control precautions should be implemented. In addition, policies should be developed for discontinuation of isolation when appropriate. Three negative rectal swab samples obtained at least one week apart is the suggested criterion. A system for highlighting charts of patients with VRE should be developed so that they can be appropriately isolated if readmitted.

**Table III: Synopsis of HICPAC recommendations for preventing the spread of vancomycin resistance.**

**Table IV: CDC recommendations for the management of suspected viral haemorrhagic fever.**

- Place the patient in a private negative pressure room. An ante-room is useful for donning personal protective equipment.
- Non-essential staff and visitors should not enter
the room.

- Gloves and gowns should be worn. Surgical masks and eye protection (e.g., goggles) are mandatory when within three feet of the patient. HEPA respirators should be used if the patient is coughing, vomiting, or haemorrhaging, or has diarrhoea.
- Standard precautions should be followed to minimise the risk of injuries by sharps.
- Clinical laboratory specimens should be transported to and handled in the lab with special precautions. Consultation with experts in biosafety should be obtained.
- Environmental surfaces and contaminated objects should be cleaned and disinfected. Linen can be autoclaved or incinerated.
- Bodily wastes should be autoclaved or disinfected prior to disposal. Medical waste such as needles and syringes should be incinerated or disinfected.
- If the patient dies, the corpse should be placed in a sealed, leakproof material, and cremated or buried in a sealed casket. Autopsies should only be performed with the assistance of State health authorities and the CDC.
- Exposed persons should be placed under close medical surveillance and receive appropriate follow-up.

Prevention of *M. tuberculosis*

Every healthcare facility should have a written TB infection control plan for each area of the facility and for each occupational group not assigned to a specific area. Periodic risk assessment is essential and should include the following elements:

Review of the incidence of TB, case surveillance, review of drug susceptibility, tuberculin skin testing of HCWs, assessment of adherence to the TB infection control programme, review of pertinent engineering maintenance.

**Early identification of patients with active TB:** Physicians must be astute in identifying patients who may have active TB. Chest radiography and PPD testing of the patient provides important supportive data. Any hospitalised patient with significant suspicion of active pulmonary (or laryngeal) TB should be placed immediately in a negative pressure isolation room (NPIR). Out-patient management of suspected or confirmed active TB will minimise exposure of others.

**TB isolation rooms:** Negative pressure is employed to prevent the escape of droplet nuclei. To further this goal, doors must be kept closed, and negative pressure should be verified daily.

**Respiratory protection masks:** These masks must filter particles 1 μm in diameter with at least 95 per cent efficiency (N95) given flow rates up to 50 l per minute, must fit to a person’s face with less than 10 per cent seal leakage, and should be available in several sizes to optimise fit.

**Healthcare worker screening:** PPD testing should be done immediately prior to employment. Screening should be repeated at regular intervals according to the risk of occupational exposure to TB (usually every year).

**Surveillance for patient-to-patient transmission of TB:** Routine surveillance of active TB cases should be monitored for clues of patient-to-patient transmission: high proportion of cases with contacts of patients and HCWs with active infectious TB.

**Clinical situations where use of vancomycin is considered essential**

Treatment of patients with infections caused by staphylococcal species and streptococcal species; used orally for staphylococcal enterocolitis, or for antibiotic-associated pseudomembranous colitis produced by *C. difficile*.

For preventing and controlling the spread of vancomycin resistance, with a special focus on vancomycin resistant enterococci (VRE), will require coordinated, concerted efforts from all involved hospital departments, and can be achieved only if each of the following elements is addressed:

a) prudent vancomycin use by clinicians, b) education of hospital staff regarding the problem of vancomycin resistance, c) early detection and prompt reporting of vancomycin resistance in enterococci and other gram-positive microorganisms by the hospital microbiology laboratory, and d) immediate implementation of appropriate infection-control measures to prevent person-to-person transmission of VRE.

**Conclusion**

With the advances in the hospital facilities, more patients reside in nursing homes. In recent years, the acuity of illness...
of nursing home residents has increased. Long-term-care facility residents have a risk of developing nosocomial infection that is similar to acute-care hospital patients. A great deal of information has been published concerning infections in the long-term-care facility, and infection control programmes are nearly universal. Tuberculosis, blood borne pathogens, epidemics, isolation systems, immunisation, and antibiotic-resistant bacteria are gaining importance. Recommendations are developed for long-term-care infection control programmes based on interpretation of currently available evidence. The recommendations cover the structure and function of the infection control programme, including surveillance, isolation, outbreak control, resident care, and employee health.

References


THE CADUCEUS

A caduceus (kerykeion in Greek) is a staff with two snakes wrapped around it.

The caduceus was a symbol of commerce and is associated with the Greek God Hermes. It was originally a herald’s staff, sometimes with wings, with two white ribbons attached. The ribbons eventually evolved into snakes in the figure-eight shape.

Its origin is thought to be as early as 2600 BC in Mesopotamia. It was used by the priests in the Eleusinian Mysteries of ancient Greece, and has been associated with the Gnostic Corpus Hermeticum and Kundalini Yoga, where it is thought to be a symbolic representation of the “subtle” nerve channels – the “ida”, “pingala”, and “sushumna” – described in yogic kundalini physiology.

In modern times it is often used interchangeably with the Rod of Asclepius, associating the caduceus with medicine, especially in the United States. Historically, the two symbols had distinct and unrelated meanings. Occasionally the caduceus may be combined with a DNA double-helix, which the intertwined snakes coincidentally resemble.