226 The Contagious Patient

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The inevitable risk borne by medical workers in the process of caring for patients with contagious diseases has been historically most apparent in epidemics, during which physicians have selflessly treated patients known to have dangerous, communicable infections. Investigators of infectious diseases still must face hazards when they work with microorganisms of uncertain danger and contagiousness, as exemplified by the death of Howard Ricketts in the study of typhus and the risks incurred by researchers working with HIV, the AIDS virus. Our knowledge of how infectious diseases are spread and the development of prudent infection control guidelines, however, have eliminated much of the risk for modern physicians. Physicians who follow accepted rules for patient isolation, acquire a basic knowledge of how infections are transmitted, and receive proper immunizations will set an example of responsible behavior for other medical and paramedical workers, and protect themselves and other patients from unnecessary hazard.

Transmission of Infectious Diseases

The four principal routes by which infections may be transmitted from patient to physician or vice versa form the basis of hospital infection control guidelines.

1. *Contact transmission* is the most important manner in which physicians may contract or spread infectious diseases. It may occur through direct physical contact (e.g., examining a wound), indirect contact through a formite (e.g., changing wound dressings or using a contaminated medical instrument), or droplet contact in which airborne infectious agents are spread short distances through coughing or sneezing. Most nosocomial infection with multiple-antibiotic-resistant bacteria, for example, derives from contact spread of microorganisms by physicians or staff.
2. *Vehicular transmission* involves contaminated objects, for example, food (salmonellosis), blood (hepatitis), water (legionellosis), or drugs and supplies (e.g., contaminated intravenous catheters or intravenous fluids and drugs).
3. *Airborne transmission* implies the dissemination of infectious particles suspended in air (e.g., tuberculosis), often for long distances.
4. *Vector transmission,* as through insect or animal spread, is more relevant to geographic medicine than clinical practice.

Other important microbial and clinical factors relating to the specific circumstances of the encounter between a physician and a patient also influence the "contagiousness," or likelihood of successful transmission, of an infectious disease. For example, large inoculum of organisms increases the chance of infection, regardless of the intrinsic capacity of an organism to cause human disease; hence, an otherwise harmless organism, when ingested in large numbers, may cause fever and vomiting (e.g., *Bacillus cereus,* a common cause of "food poisoning"). Microorganisms vary greatly among species, and even among strains within the same species (e.g., the highly variable disease that results from infection with the various strains of *Escherichia coli*), in their capacity to cause human disease and the severity or types of symptoms they cause. These characteristics are referred to as the *virulence* of an organism. The condition and state of immunity of the host are important; age, vaccination history, the presence of comorbid chronic diseases, previous encounters with that particular microorganism, the status of the host's immune system (e.g., leukemic patients), and the intactness of the usual defenses such as cough, free drainage of the urinary tract, healthy skin, and the presence of normal resident bacterial flora can determine whether infection occurs and how it is manifested.

The Centers for Disease Control recommends that hospitals use one of two isolation procedure systems: the traditional, disease-specific system or a newer category-specific system which groups together diseases that call for similar isolation precautions. Listed in Table 226.1 are most of the community-acquired adult contagious diseases that a physician might encounter in a general hospital, the usual infectious materials (important exceptions may occur, especially for immunocompromised hosts), and the usual type and duration of isolation. More detailed recommendations are found in the references at the end of this chapter. Many infectious diseases require no isolation: most fungal infections, arthropod-borne viral and rickettsial infections, most bronchitis and viral upper respiratory infections of adults, food poisoning, infectious mononucleosis, and most sexually transmitted diseases require little more than a commonsense approach to patient management.

The category-specific isolation precautions recommended by the Centers for Disease Control (CDC) are listed in Table 226.2. Individual hospitals may modify or supplement these guidelines to meet their own needs, and physicians should discuss modifications that may help meet a particular patient's needs with the hospital epidemiologist when appropriate. Isolation may be instituted by physician's order or, in some hospitals, by nurses or the infection control committee. It is usually discontinued after the illness or infectious lesion has resolved, the cultures that caused the institution of isolation are negative, or shortly after effective treatment has been instituted in some easy-to-treat community-acquired infections (e.g., meningococcal infections).

In 1987 the CDC recommended that *all* patients have a type of blood/body-fluid (B/BF) precautions, referred to as *universal precautions,* because history and examination cannot reliably identify patients infected with HIV or other bloodborne pathogens:

Table 226.1
Infectious Diseases That May Be Spread by or Contracted by Physicians during Ordinary Patient Care Activities[a]

Disease	Infective materials	Isolation	Duration
Acquired immunodeficiency syndrome (AIDS)	Blood/body fluids	U	DI
Babesiosis	Blood	B/BF	DI
Conjunctivitis (bacterial, viral, chlamydial)	Purulent exudate	D/S	DI
Creutzfeldt-Jacob disease	Blood/brain/CSF	B/BF	DH
Encephalitides (except anthropod borne)	Feces	E	DI
Gastroenteritis (all types)	Feces	E	DI
Hepatitis A	Feces	E	1 wk after onset of jaundice
Hepatitis B	Blood/body fluids	B/BF	Until HBsAg negative
Non-A, non-B hepatitis	Blood/body fluids	B/BF	DI
Herpes simplex, cutaneous	Secretions from lesions	C or D/S	DI recurrent—until crusting
Herpes zoster, disseminated	Lesion secretions Possibly respiratory	S S	DI
Herpes zoster, localized	Lesion secretions	D/S	Until crusting
Measles	Respiratory secretions	R	For 4 days after rash appears
Meningitis, *H. influenzae, N. meningitidis*	Respiratory secretions	R	For 24 hr after effective treatment begun
Mumps	Respiratory secretions	R	For 9 days after onset of swelling
Pediculosis, scabies	Infected skin	C	For 24 hr after effective treatment begun
Pertussis	Respiratory secretions	R	For 7 days after start of effective therapy
Rabies	Respiratory secretions	C	DI
Streptococcal and staphylococcal infections	Respiratory and lesion secretions	C	For 24 hr after effective treatment begun
Syphilis, primary and secondary	Blood, lesion secretions	B/BF D/S	For 24 hr after effective treatment begun
Tuberculosis	Airborne droplets, lesion drainage	TB	Usually 2–3 wk after effective therapy begun

[a]The type of isolation recommended by the Centers for Disease Control is determined by the type of infective materials.
DI = duration of illness, DH = duration of hospitalization, B/BF = blood/body fluid precautions, D/S = drainage/secretion precautions, E = enteric precautions, C = contact isolation, S = strict isolation, R = respiratory isolation, TB = tuberculosis isolation, U = universal precautions.

Table 226.2
Category-Specific Isolation Precautions Recommended by the Centers for Disease Control

Category	Private room	Masks	Gowns	Gloves	Handwashing
Strict (S)	+	+	+	+	+
Contact (C)	+	If close contact	If soiling likely	For contact with infective material	+
Respiratory (R)	+	If close	—	—	+
Tuberculosis (TB)	+	If cough present	—	—	+
Enteric precautions (E)	If poor hygiene	—	If soiling likely	For contact with infective material	+
Drainage/secretion precautions (D/S)	—	—	If soiling	For contact with infective material	+
Blood/body fluid precautions (B/BF)	If poor hygiene	—	If soiling likely	For contact with infective material	+
Universal (U) for HIV	—see text—				

1. Barrier precautions (gloves, masks, eyewear, gowns) should be used routinely in the appropriate circumstances when contact with blood, tissue fluids, semen, or vaginal fluid is anticipated.
2. Hands should be washed after glove removal and contaminated skin washed after exposure.
3. Special precautions to prevent puncture injuries should be observed.
4. Mouth protection should be used for mouth-to-mouth resuscitation.
5. Contact with weeping skin lesions should be avoided.
6. Pregnant health care workers are at special risk and should be especially observant of all precautions.

Physicians are ethically obliged to follow isolation guidelines compulsively for the protection of their patients and themselves. Any lapses in following their own rules are acutely noted by other caregivers and the patient's family.

Isolation, it must be remembered, is not harmless. Elderly patients may become disoriented, all patients become depressed, friends are hesitant to visit, nursing care may suffer, and physicians become reluctant to touch patients

or visit them as frequently after isolation procedures are instituted.

Nosocomial Infections

Hospital-acquired infections, defined as ones not present or incubating at hospital admission, occur in approximately 5% of admissions; older, immunocompromised patients, however, have a much higher incidence of nosocomial infection. When these infections occur, hospitalization is prolonged an average of 5 to 10 days, health care expenses are greatly increased, and the morbidity and mortality experienced from the primary illness are increased. Nosocomial infections are often caused by multiple-antibiotic-resistant organisms (e.g., pseudomonas, serratia, acinetobacter, enterobacter) that are rarely encountered in community-acquired infections; successful treatment of these organisms is more difficult, requiring complicated, expensive, and toxic antibiotic regimens.

Physicians, nurses, and other health care workers in the hospital are, to a large degree, responsible for the spread of these bacteria, permitting them to colonize the respiratory tracts, urinary tracts, and skin of patients who might otherwise be colonized with less virulent, more antibiotic-sensitive organisms. It is commonly observed, for example, that urinary infections often occur in clusters of patients infected with the same strain of multiple-antibiotic-resistant bacteria and that the only apparent epidemiologic connections between these patients are their physicians and nurses.

Compulsive handwashing after *every* patient is examined, whether they are known to be infected or not, is prudent. Patients with infected wounds, respiratory infections, cellulitis, decubitus ulcers, and urinary infections may be infected with virulent, multiple-antibiotic-resistant organisms. Table 226.2 lists the standard precautions that should be exercised for patients recognized as having a potentially contagious infection. Infected patients who have not been placed on isolation should be touched with caution, gloves or mask should be used when common sense dictates, and hands should be carefully washed before going to the next patient.

Protection of Health Care Workers from Infectious Diseases

While health care workers rarely contract infectious diseases from their patients, some infections represent a special risk, and vaccination, treatment, or surveillance is recommended; many hospitals, in fact, require some vaccinations to reduce employee absenteeism and protect employees and patients (such requirements result from the nearly universal poor compliance of hospital workers with reasonable recommendations).

Hepatitis B. Up to 20% of health care workers have evidence of past hepatitis B infection (anti-HBs or anti-HBc positive) and approximately 1% are carriers (HBsAg positive). Personnel at high risk for exposure to the blood of patients who are hepatitis B carriers (e.g., hemodialysis workers, laboratory personnel, surgeons, pathologists) should receive three intramuscular doses of hepatitis B vaccine; immunization is optional for lower-risk personnel. Actual percutaneous exposure to a patient's blood, usually through needlestick, requires first an assessment of the likelihood that the blood was HBsAg positive. If the source of the blood is unknown or testing for HBsAg will require more than 24 to 48 hours, 5 ml of immune serum globulin (ISG), which provides some protection against hepatitis B, may be given; in low-risk exposures, however, a reasonable option is not to treat. For high-risk exposures that require more than 24 to 48 hours to determine the infectivity of the blood, 5 ml of ISG should be given; for known or likely exposures to HBsAg-containing blood, two options are available. A single 5 ml dose of hepatitis B immune globulin (HBIG) and 1 ml of hepatitis B vaccine may be given at separate sites within 24 hours, with repeat doses of vaccine at 1 and 6 months. Alternatively, 5 ml of HBIG can be given intramuscularly within 24 hours and repeated at 1 month; this regimen is more costly and probably less effective. ISG can be given while waiting if HBIG is not immediately available. Persons immunized with hepatitis B vaccine who have adequate HBsAb levels or those who are already positive for HBsAb from a prior infection do not require either active or passive immunization.

Non-A, non-B hepatitis. Personnel with percutaneous exposure to blood of patients with non-A, non-B hepatitis may be given 5 ml of ISG. Effectiveness in ameliorating or preventing infection is possible, but has not been established; ISG, however, is safe and inexpensive.

Hepatitis A. Nosocomial exposure is unlikely; ISG 2 to 5 ml should be given as soon as possible when exposure does occur.

Rubella. All hospital personnel working with pregnant women, and all personnel in some hospitals, should be screened for immunity to rubella. Those who are seronegative should receive rubella vaccine. Vaccination of all health care personnel, without prior serologic testing, is a more cost-effective but often politically unacceptable option.

Influenza. Hospital personnel may transmit influenza to immunocompromised and elderly patients and are, therefore, advised to be immunized regularly for their patients' benefit; moreover, absenteeism among infected health care workers would compromise the ability to care for the large numbers of sick persons. Compliance with this recommendation is universally low. Amantidine prophylaxis of health care workers during outbreaks is another option.

Varicella-zoster virus. Varicella is highly contagious, but fewer than 10% of adults are susceptible to infection. Because adult chickenpox is often more severe than childhood infection, health care workers without a history of chickenpox should avoid contact with infected patients, their dressings and clothing. Accidental exposure is possible because respiratory spread may occur before vesicles appear; in these circumstances, the fluorescent antibody membrane antigen assay can be used to document whether the health care worker has prior immunity. Nonimmune exposed employees should not work from days 10 to 21 after exposure; they may be considered candidates for varicella-zoster immune globulin (VZIG), which has usually been reserved for high-risk exposures in the past (e.g., immunocompromised hosts).

The vesicles of varicella-zoster are also contagious, but less so. Covering the vesicles with dressings greatly reduces the risk for nonimmune caregivers.

Herpes simplex virus. Health care workers may develop painful herpetic whitlows (paronychia) from contact with patients with herpes virus vesicles; workers with oral herpes may transmit serious infection to immunocompromised patients, newborns, and patients with burns. Oral acyclovir treatment will accelerate healing and decrease the infectious

period of primary and secondary herpes infections, and should be encouraged.

Cytomegalovirus. Pregnant health care workers may be more likely to be exposed to cytomegalovirus (CMV) than women not working in a hospital setting; patients likely to have CMV infections (e.g., older patients with seronegative hepatitis, transplant, or AIDS patients) should be avoided.

Acquired immunodeficiency syndrome (AIDS). The AIDS-associated virus (HIV) is not very infectious—the risk of infection after needlestick is less than 1%, compared to about 25% for hepatitis B—and is easily inactivated by standard disinfection procedures. Casual contact never leads to infection. Only a handful of health care workers has become infected as a result of work-related exposure; the consequences are, nevertheless, grave and require care on the part of those at risk for exposure. *Universal precautions* are recommended for all patients to prevent the transmission of HIV and other bloodborne diseases, plus the relevant type of precaution with patients who have contracted other infectious diseases (e.g., tuberculosis of salmonella enteritis).

Tuberculosis. As the prevalence of active tuberculosis declines, the previous routinely experienced conversion of the PPDs of medical students and residents to positive is no longer seen. Although some hospitals still recommend routine screening, baseline and periodic skin testing is reasonably reserved to those recently exposed, to hospitals or geographic regions known to have a high prevalence of active tuberculosis, or to health care workers at higher risk of exposure. Knowledge of the "booster effect" of skin testing is important to health care workers who are routinely tested: a person with a previous tuberculosis exposure becomes skin test negative over time but reverts to positive after the initial skin test, and is incorrectly assumed to be a recent converter when the PPD is repeated a year later. Two-stage testing should be done, therefore, for health care workers over 35 years old whose first skin test is negative. Tuberculin-negative health care workers should be retested 2 to 3 months after exposure to a patient with active tuberculosis. The possibility that respiratory symptoms in health care workers may be due to tuberculosis should be seriously considered because of the chance of their transmitting tuberculosis to older or immunocompromised patients.

Meningococcal meningitis. Up to 10% of healthy persons may be colonized with *Neisseria meningitidis.* Patients with meningococcal meningitis, however, are presumed to be infected with a relatively virulent strain that is more likely to result in the development of meningitis in close contacts who become colonized. While the usual risk to health care providers is negligible, those who have intimate contact with patients who have not yet received 24 hours of effective antibiotic therapy may be given rifampin 600 mg twice daily for 2 days. In the absence of data indicating an increased risk for health care workers, a perhaps more rational approach is close surveillance for 10 days to ensure early treatment of secondary cases.

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