Infection control and its application to the administration of intravenous medications during gastrointestinal endoscopy

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Several infection control practices and procedures crucial to the prevention of disease transmission in the health care setting are reviewed and discussed. Emphasis is placed on the importance of infection control to gastrointestinal endoscopy. Recommendations that minimize the risk of nosocomial infection during the preparation, handling, and administration of intravenous medications, particularly propofol, are provided. These recommendations include the labeling of predrawn syringes; use of sterile single-use syringes, needles, and administration sets for each patient; and, whenever feasible, administration of intravenous medications promptly after opening their prefilled syringes or after opening their ampoules or vials and filling the sterile syringes. (Am J Infect Control 2004;32:282-6.)

Outbreak and pseudo-outbreak investigations have identified medical devices, environmental surfaces, patients, and health care workers as sources of contamination and nosocomial infection (NI).[1-6] Modes of disease transmission include patient to patient (or cross-infection),[1-3,7] surface to patient,[5,6,8-10] and the exchange of pathogens between patients and health care workers.[11-13] The primary goal of infection control is to prevent NIs by interfering with crucial mechanisms required for each of these 3 modes to transmit disease successfully. In the operating room setting, where invasive procedures are routinely performed and the risk of NI is significant, the principles of infection control and aseptic technique are well established and rigorously practiced. The importance of the application of these principles to gastrointestinal (GI) endoscopy, however, which is often performed in an office-based, outpatient setting, may at times be overlooked or not as clearly appreciated. Despite its limited invasiveness, lack of a sterile field, and very low reported risk of NI, GI endoscopy requires strict adherence to published infection control guidelines to prevent disease transmission.[14-16] To underscore their contribution to minimizing the risk of NI not only in the operating room setting, but also in the GI endoscopy setting, various crucial infection control practices and procedures are reviewed and discussed. Several recommendations that prevent disease transmission during the preparation, handling, and administration of intravenous (IV) medications, particularly propofol, are provided.

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IMPORTANT INFECTION CONTROL PRACTICES AND PROCEDURES

Masks, gowns, and gloves

Acting as barriers to the passage of microorganisms and other contaminants, masks, gowns, gloves, head covers, protective eyewear, and other appropriate attire serve not only to prevent contamination of the sterile field by surgical staff, but also to minimize the risk of exposure of surgical staff to a patient's potentially contaminated tissues, blood, and other body fluids.[5,17] For some types of infectious agents, such as the coronavirus that has been etiologically linked to severe acute respiratory syndrome (SARS), respirators instead of standard surgical masks may be required to prevent NI. The Occupational Safety and Health Association requires that, when engaging in any patient care activity that may result in exposure to potentially contaminated blood or other infectious materials, health care workers must wear gloves (and other protective attire) to prevent disease transmission by way of contaminated hands.[18] Gloves have their limitations, however, and are not intended to replace or eliminate handwashing. Moreover, because gloves can tear and their function as a protective barrier become compromised, double gloving may be advantageous and important to minimize the risk of exposure to blood-borne pathogens.[19,20] Gloves should be removed after caring for each patient.[18,21]

Instrument cleaning, packaging, and sterilization

For a sterilization process to be effective, the instrument must first be thoroughly cleaned, usually using ultrasonic energy to aid in the dislodgement of adherent debris in the narrow crevices and inaccessible surfaces of complex surgical instruments.[22] Some instruments may require complete or partial disassembly before cleaning and sterilization. Failure to thoroughly clean all of a reusable instrument's potentially contaminated surfaces significantly increases the risk of sterilization failure and NI.[1,2,7] The use in the sterile field of only sterile instruments as prescribed by aseptic technique is one of infection control's most crucial requirements. Not all instruments used during a surgical procedure, however, require sterilization. Whereas sterilization is required for all critical instruments that penetrate sterile tissue or enter the vascular system, such as biopsy forceps used during GI endoscopy, scalpels, and IV catheters, high-level disinfection is recommended for semicritical instruments that routinely contact mucous membranes, such as GI endoscopes, bronchoscopes, and respiratory therapy equipment.[23] The proper packaging or wrapping, storage, and handling of surgical instruments is also important to prevent contamination of the sterilized instrument before its use and introduction into the sterile field.

Environmental cleaning

Another infection control practice that is important to prevent NI is the decontamination of the health care facility's environmental surfaces.[24] Risk of transmission of infectious agents between patients and health care workers increases whenever surfaces, particularly those in the operating room and other areas where surgical procedures may be performed, are not thoroughly cleaned (and disinfected) as recommended.[25] When visibly soiled with blood, tissue, or body fluids after a surgical procedure, furniture and equipment in the operating or procedure room require cleaning. Similarly, when visibly soiled, the walls, doors, and surgical lights require spot cleaning.[24] In general, it is recommended to clean the operating room's entire floor once at the end of the day, a practice known as "terminal cleaning." When visibly soiled after a procedure, however, a perimeter of a few feet around the surgical field requires cleaning. Data in support of cleaning the entire floor of the operating room after each surgical procedure are lacking.[24]

Handwashing, hand hygiene

No review of the application of infection control to the prevention of disease transmission in either a traditional operating room setting or an office-based, outpatient GI endoscopy setting would be complete without a discussion of the importance of proper handwashing and hand hygiene. Indeed, these arguably are infection control's 2 most important practices.[5,23,26] Failure of health care workers to wash their hands and to comply with hand hygiene guidelines is a leading cause of NI and the spread of multiple-resistant microorganisms.[18,25,27] Nevertheless, despite the plethora of data that demonstrate the importance and effectiveness of frequent handwashing to the prevention of disease transmission, reports indicate that compliance by health care workers with published handwashing guidelines is often poor.[18,28] Reasons for poor compliance are many and include skin irritation and dryness linked to hand detergents; high patient workload and understaffing, which can limit the amount of time available for thorough handwashing and proper hand hygiene; and a shortage of hand-cleaning sinks located in convenient and easily accessible locations.[18]

Because gloves do not provide complete protection against hand contamination, compliance with handwashing and hand hygiene guidelines is necessary even when gloves are worn. (Reuse of washed gloves is contraindicated.)[18] Proper handwashing and hand hygiene is required, among other times and considerations: (1) before having direct contact with patients (eg, before performing invasive procedures);[18,23,29] (2) when hands are visibly dirty or soiled with blood or other body fluids, or when contamination of hands is suspected or is likely to have occurred;[18,23] and (3) after contact with inanimate objects, such as medical equipment, in proximity with patients.[18,23] Reports of gloves becoming perforated or torn during routine use have been documented.[18,19] Handwashing is therefore also required after removal of used gloves.[18-20]

ASEPTIC ADMINISTRATION OF IV MEDICATIONS

In general, GI endoscopy does not require either the establishment of a sterile field or that the endoscope, such as a colonoscope or esophagogastroduodenoscope, be wrapped or sterile at time of use.[30] Nor does GI endoscopy ordinarily require use of masks, gowns, or head covers. There are, however, several infection control practices and procedures for the prevention of disease transmission that are as important in the office-based, outpatient GI endoscopy setting as in the operating room setting. An example is the aseptic preparation, handling, and administration of IV medications.[3,31] Contamination of the patient's IV tubing or of an IV medication's vial, ampoule, or filled syringe, whether in an operating room setting or an office-based, outpatient GI endoscopy setting, can result in NI,

septicemia, or other serious patient complications.[10,32-35] Breaches in aseptic technique during the use of an IV medication have been linked to 3 reports of transmission of the hepatitis C virus (HCV) during GI endoscopy.[3,15,16,31] One of these reports documents HCV transmission at a GI endoscopy clinic as a result of the reuse of needles and the contamination of multiple-dose anesthesia medication vials.[3,31] Another of these reports links the transmission of HCV to the reuse of a syringe used to administer IV medications, including propofol, to 2 different patients during colonoscopy.[16] And the 3rd report suggests that contamination of multiple-dose IV medication vials or reuse of a syringe on more than 1 patient (or inadequate disinfection of the colonoscope) was responsible for HCV transmission during colonoscopy.[15]

Whereas most IV medications are not associated with bacterial contamination and unless otherwise stated on their label can be used as many as 24 hours after opening their vials, ampoules, and prefilled syringes without posing an infection risk to the patient,[36] some IV medications, albeit only a few, contain little or no preservatives or antimicrobial agents. Prompt use and special precautionary measures are required for these preservative-free IV medications, which include propofol,[37] a lipid-based emulsion that in low doses may be used as a sedative during GI endoscopy.[38] Bacterial contamination and outbreaks have been reported when aseptic technique was violated during the use of propofol.[32,33,39,40] Because propofol supports rapid bacterial growth at room temperature, and contamination with just a few bacteria can result in clinical disease,[32,35,40] prompt administration is recommended.[35,37] Although precautionary measures are required during its use, propofol is both safe and effective when used in accordance with its label.[37,38-40]

RECOMMENDATIONS

Strict compliance with published infection control guidelines is required to minimize the risk of disease transmission in the health care setting. In particular, it is essential as required and as recommended to wear masks, gowns, and gloves; to clean, package, and sterilize (or high-level disinfect) reusable surgical instruments; to clean environmental surfaces; and to practice proper handwashing and hand hygiene.[17,18,23,24] The practice of aseptic technique during the preparation, handling, and administration of IV medications is also necessary to prevent nosocomial disease transmission. The following recommendations, which apply not only to the operating room setting, but also to (and are emphasized for) the office-based, outpatient GI endoscopy setting, are provided to reduce the risk of NI and other adverse patient outcomes during the use of IV medications, particularly propofol.

1. Read the label and package insert of each IV medication before its handling and administration, to ensure compliance with its intended use. Check daily each medication's expiration date and discard all that have expired.
2. Label each predrawn syringe. Include the medication's name, its strength and dosage, the date and time the ampoule or vial was opened, and when the syringe was filled.[36] This practice is especially important when using propofol.[37] Discard all unlabeled medications.
3. Use aseptic technique during the preparation, handling, and administration of all IV medications.[31,35]
4. For each patient, use a sterile, single-use, disposable syringe, needle, and administration set (ie, IV tubing and connections).[3,31,33,40] Large-volume syringes filled with medications should be administered to only 1 patient (even if the syringe's needle is changed) and then discarded.
5. Visually inspect each IV medication before its administration. If particulate matter or discoloration is detected, or contamination suspected, discard the medication.[37]
6. Whenever feasible, administer each IV medication promptly after opening its prefilled syringe or after opening its ampoule or vial and filling the sterile syringe.[32,35,36] The practice of filling syringes with IV medications in the morning for use throughout the day (or for use the next day) can be problematic.[37,39] Unless otherwise stated on the medication's label, it is recommended that all predrawn syringes be discarded within 24 hours (or when completely used, whichever comes first).[36]
7. Propofol is an exception to this 24-hour recommendation. In general, propofol requires administration within 6 hours after opening its vial and filling the (sterile) syringe,[36,37,39,40] although prompt administration is recommended.[35] When propofol is administered directly to the patient from its original vial or prefilled syringe, without having first been transferred to another syringe or container, all unused portions must be discarded within 12 hours (rather than 6 hours).[36,37]
8. Before inserting a sterile needle, disinfect the vial's stopper or the ampoule's neck surface using 70% isopropyl alcohol (or its equivalent).[35,37]
9. Whenever feasible, the use of single-dose medication vials, prefilled syringes, and ampoules is recommended. Do not puncture a single-dose vial more than once. Note that the labels of some IV medications, such as propofol, limit the use of its prefilled syringes and vials to only 1 patient.[31,35,37,40]
10. Care is emphasized and caution warranted whenever using multiple-dose vials, as their use has been associated with transmission of HCV and other infectious

agents.[3,13,16,31,41] Do not pool into a single vial residual medications from 2 or more other vials, for future use.[3]
11. Mixing more than 1 medication in a single syringe for their simultaneous administration is not recommended.[36]
12. After their use, promptly discard all syringes and needles at the point of use in an appropriate puncture-resistant and leak-proof sharps container.[31]
13. Establish a quality assurance and infection control program that encourages the health care workers responsible for filling syringes to also be in charge of handling and monitoring the syringes before administration of IV medications.
14. Store all unused IV medications, syringes, and needles in a clean and secure area, to prevent contamination, misuse, and theft.[34]

CONCLUSIONS

Applicable to virtually every health care setting, infection control is a set of practices and procedures that minimize the risk of nosocomial disease transmission. Periodic review of these practices and procedures to ensure they are up-to-date and account for new and emerging infectious diseases, such as variant Creutzfeldt-Jakob disease and SARS, is recommended. Whereas infection control and aseptic technique in the operating room setting is universally practiced and understood, their application to the GI endoscopy setting, where sterile tissue is not always violated and sterile instruments not always required,[30] is sometimes less clear and not always as strictly enforced or exercised. Indeed, specific violations in aseptic technique have been implicated as the cause of disease transmission during GI endoscopy.[3,14-16,31] As a result, presentation of educational sessions that discuss and review the application of infection control and aseptic technique to GI endoscopy is recommended. Also recommended is the development of programs designed to improve understanding of the modes of disease transmission and compliance with the principles of infection control, aseptic technique, standard precautions, contact precautions, droplet precautions, and airborne precautions, as each applies not only to the traditional operating room setting, but also to GI endoscopy (and bronchoscopy).[42] Establishment of a quality control program that monitors adherence to aseptic technique during the preparation, handling, administration, and storage of IV medications, particularly propofol, is emphasized.

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