Guidelines for Infection Control in Intravenous Therapy

DONALD A. GOLDMANN, M.D., DENNIS G. MAKI, M.D., FRANK S. RHAME, M.D., ALLEN B. KAISER, M.D., JAMES H. TENNEY, M.D., and JOHN V. BENNETT, M.D.,
Atlanta, Georgia, and Boston, Massachusetts

Infusion-associated sepsis is an appreciable hazard to the more than 8 million patients who receive intravenous therapy in U.S. hospitals each year. Rigorous infection control measures are necessary if the risk of sepsis is to be reduced. Based on CDC studies and a critical review of previously published investigations, guidelines are proposed for the prevention and management of infections caused by intravenous therapy.

Intravenous therapy is associated with an appreciable risk of life-threatening sepsis. Although it is unlikely that infusion-associated infections can ever be completely eliminated, they can be minimized if physicians, nurses, and other hospital personnel adhere to established infection control procedures when administering intravenous fluids. The following guidelines have been developed to provide these individuals with a practical approach to infection control in conventional intravenous therapy.

Background and documentation for these recommendations are contained in the review article, “Infection Control in Intravenous Therapy,” on pages 867-887 of this issue. Long-term catheterization for the purpose of total parenteral nutrition requires additional safeguards, and appropriate guidelines have recently been published.*

Judicious Use of Intravenous Therapy

Intravenous cannulae should be inserted only when clearly indicated by the patient’s clinical requirements. Intravenous therapy should not be used when oral therapy would suffice, nor should slow drip “keep open” intravenous infusions be maintained for convenience in the absence of specific therapeutic indications.

Choice of A Cannula

1. Although no controlled clinical trials have directly compared rates of infection with stainless steel needles and plastic catheters, several studies have shown very low rates of infection with “scalp vein” needles. Therefore, steel needles should be used for intravenous therapy whenever possible. Indiscriminate use of plastic catheters, solely for convenience, places the patient in needless jeopardy. However, plastic catheters provide a more secure avenue for the administration of medications to the critically ill patient, and centrally placed catheters are required for monitoring venous pressure.

2. Intravenous cannulation of the lower extremities should be avoided because of the high incidence of associated complications.

Cannula Insertion and Care

1. The hands of hospital personnel are commonly contaminated with multiply resistant bacteria. To maintain asepsis, hands should be thoroughly washed and care taken not to touch the needle or skin site when inserting intravenous cannulae. For optimal asepsis, sterile gloves and drapes are required, although this might not always be possible, especially in emergency situations. Cannulae inserted without proper asepsis should be replaced at the earliest opportunity.

2. The site chosen for cannula placement should


From the Bacterial Disease Branch, Epidemiology Program, Center for Disease Control, Health Services and Mental Health Administration, Department of Health, Education, and Welfare, Atlanta, Georgia, and the Harvard Medical Service, Boston City Hospital, Boston, Massachusetts.
be prepared with an effective antiseptic. Iodine-containing antiseptics have a superior spectrum of antimicrobial activity, compared with other commercially available preparations. Tincture of iodine (2% iodine in 70% alcohol) is inexpensive, well tolerated, and highly reliable, but a history of iodine allergy should be sought before use. Solution should be liberally applied, allowed to dry for at least 30 seconds, and washed off with 70% alcohol. Both agents should be applied with friction, working from the center of the field to the periphery. An iodophor may be substituted in patients with sensitive skin but should not be washed off with alcohol because its germicidal action may depend partially on the sustained release of free iodine. In the rare case that iodine preparations cannot be tolerated, vigorous, prolonged (at least 1 minute) washing with 70% alcohol is acceptable. Aqueous benzalkonium chloride and other quaternary ammonium compounds should not be used for antisepsis.

3. After the intravenous administration route is established, the cannula should be securely anchored to prevent irritating to-and-fro motion and to avoid transport of cutaneous bacteria into the puncture wound. Although evidence is not conclusive, additional protection from infectious complications may follow applications of a topical antimicrobial preparation to the cannula site. Since studies have suggested that antibiotic ointments favor the selective growth of resistant bacteria and Candida, the use of a topical antiseptic, such as an iodophor ointment, should be considered. However, controlled studies to establish the safety and efficacy of antiseptic ointments are needed. The infusion site should be covered with a sterile dressing.

4. When an intravenous cannula is inserted, the date and time of insertion should be recorded. Indwelling cannulae should not be left in place longer than 72 hours and preferably should be changed at 48-hour intervals. If continued intravenous therapy is required in a patient with few available veins, this guideline may need to be modified. However, such modification binds the physicians and nurses caring for that patient to even more rigorous adherence to aseptic methods. Increased vigilance is also necessary when administering intravenous therapy to patients with any active infections, since such patients appear to have an especially high frequency of infection-associated sepsis.

5. The infusion site should be inspected daily, with aseptic technique, and the dressing should then be changed and antimicrobial ointment reapplied. The administration of fluid should be immediately discontinued if signs of inflammation, phlebitis, or purulence are detected. Although it may be difficult to find alternative veins for therapy, it is important that the site be changed if these signs are observed. Intravenous cannulae may be responsible for sepsis even if local signs of inflammation are not present.

Prevention of Contamination and Care of the Delivery System

1. Recent outbreaks of septicemia associated with intrinsic contamination of intravenous products have emphasized that fluids arriving at the hospital are not necessarily sterile. Intravenous fluid containers should be examined before use and discarded if turbidity or precipitate is detected; however, absence of turbidity or precipitate does not guarantee freedom from fluid contamination. Bottles of intravenous fluid should be routinely inspected for cracks since fungal or bacterial contamination can occur through a crack so small that fluid does not leak. Bottles lacking a vacuum when opened should not be used, and plastic bags should be gently squeezed to detect punctures.

2. Every container should be clearly labelled with the patient's name, added medications, and time of opening. An accurate record of intravenous therapy, ideally including time period, type of fluid, and additives for each bottle administered, should be entered in the patient's chart; this would be greatly facilitated by the use of tear-away gummed labels on intravenous containers.

3. Several studies have shown that fluid within intravenous systems often becomes contaminated from extrinsic sources and that the frequency of contamination rises with increasing duration of uninterrupted infusion. Many common hospital pathogens proliferate very rapidly at room temperature in intravenous fluids, and small numbers of contaminating organisms can multiply by more than 5 logs in 24 hours. Should contamination occur, the patient may be exposed to an increasing inoculum of pathogens the longer the same administration set and container are left in use. Intravenous fluid should be used as soon as possible after opening, and no bottle or bag should be left in place for more than 24 hours. For clinically indicated “keep open” infusions, 250-ml containers should be used to assure compliance with this recommendation. Administration sets should ideally be changed every 24 hours, preferably when the container is changed. Bottles and tubing should also be changed when cannulae are replaced and after administration of blood products.

4. Attention has recently been given to the possibility of using terminal membrane filters to diminish
the likelihood of infection secondary to contaminated intravenous solutions. A 0.45-micron filter will block the passage of all fungi and bacteria, except for some types of *Pseudomonas* and aberrant bacterial forms. A 0.22-micron filter will block all bacteria, but a pump is often necessary to insure rapid flow of viscous solutions. Care should be taken to avoid contamination of the intravenous system when inserting and manipulating filters. There have been no controlled clinical trials to verify the effectiveness of filters in reducing infection.

**Management of Suspected Infusion-Associated Sepsis**

1. Infusion-associated sepsis may be indistinguishable from sepsis in other causes, unless it is accompanied by phlebitis. Should sepsis of obscure origin develop in a patient receiving intravenous therapy, blood cultures should be obtained from at least two independent venipunctures, and the intravenous fluid system, including the administration set, container, and cannula, should be immediately discontinued.

   The skin at the cannula site should be cleansed with an effective antiseptic, the cannula aseptically removed, and the tip of the cannula clipped off with sterile scissors into blood culture or other appropriate liquid media*. Any pus from the wound should be Gram-stained and cultured. If indicated, intravenous therapy may be resumed at another site with entirely new apparatus.

   When septicemia related to contaminated fluid is suspected, 20 ml of fluid should be aseptically withdrawn from the intravenous line, 1 ml used to prepare a pour plate, and the rest inoculated into blood culture bottles. Detection of low-level contamination may require a more sensitive culturing method. The entire volume of fluid remaining in the intravenous container may be cultured by adding to the container an equal volume of brain-heart infusion broth enriched with 0.5% beef extract (or a proportionately smaller quantity of concentrated broth) and incubating at 37 °C*. Empty containers may be cultured by adding a small amount of enriched broth and swirling the media. In addition to culturing fluid in use at the onset of sepsis, an attempt should be made to retrieve and culture any other containers of fluid administered to the patient in the previous 24 hours. All culturing should be performed in a clean, sheltered part of the laboratory and, if possible, under a laminar flow hood. The working area should be monitored with settling plates.

   All cultures should be incubated for at least 7 days before being discarded as negative. Isolates should be speciated and tested for antimicrobial sensitivity. All isolates should be saved until the cause and scope of the problem have been defined.

   The nature and lot numbers of all suspect solutions should be recorded on the patient's chart and the laboratory requisition. If contamination during manufacture is suspected, all fluids bearing the implicated lot number should be saved for the Food and Drug Administration. Local health authorities and the Food and Drug Administration should be notified immediately. Culturing of unopened fluids or other infusion products is not recommended; such culturing is better performed by State or Federal agencies equipped to examine large numbers of samples with sensitive methods and laminar flow facilities.

   2. Discontinuation of the intravenous system is the single most important therapeutic step in the patient with infusion-associated sepsis, and this alone often results in dramatic clinical improvement. However, empiric antimicrobial therapy should be administered to presumptively septic, critically ill patients, pending culture and antimicrobial susceptibility results. Such therapy should include agents with activity against both penicillinase-producing staphylococci and multiply resistant Gram-negative bacilli. Treatment with antifungal agents generally should not be initiated unless there is substantial evidence for disseminated fungal infection. Diagnosis of systemic candidiasis may be aided by examining the fundus for candida endophthalmitis, by examining blood smears for intraleukocytic fungal forms, or by testing for serological response to infection.

**Intravenous Therapy Teams**

Several studies have suggested that aspesis in the maintenance of intravenous fluid systems is most efficiently and effectively implemented if an "intravenous therapy team," following an established protocol, is responsible for intravenous therapy throughout the hospital. A team assumes responsibility for selective cannula insertions and follow-up care and conducts daily surveillance of all ongoing infusions. Besides assuring rapid detection of intravenous-related problems, surveillance permits controlled clinical evaluation of new infection control measures.

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Requests for reprints should be addressed to Dennis G. Maki, M.D., Bacterial Diseases Branch, Center for Disease Control, Atlanta, GA 30333.