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Guidelines and recommendations are set forth which provide information on how to minimize the chances of disease transmission through use of CPR manikins. Although use of such manikins has never been documented as the cause of infectious disease, it is recommended that manikins be cleaned and disinfected according to specific guidelines, and also that CPR students follow hygienic practices including hand washing before manikin contact, and avoidance of active participation if the student has any symptoms of infectious disease.

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GUIDELINES FOR THE PREVENTION OF DISEASE TRANSMISSION IN THE USE OF CPR MANIKINS

Committee to Advise
The American National Red Cross

Commission on Life Sciences
National Research Council

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NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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GUIDELINES FOR THE PREVENTION OF DISEASE TRANSMISSION IN THE USE OF CPR MANIKINS

INTRODUCTION

The American National Red Cross asked the National Research Council (NRC) to provide advice on the appropriate method of cleansing CPR manikins to avoid cross-infection, particularly for herpes simplex, tuberculosis, and AIDS. Recommendations already prepared by the Centers for Disease Control (CDC) in 1978 to prevent cross-infections during CPR training in the case of viral hepatitis type B were provided by the Red Cross with its inquiry.

A panel of advisors with expertise in infectious-disease transmission was assembled by the NRC Committee to Advise the American National Red Cross. In the course of their work, members of this panel consulted extensively with representatives of the CDC and the American Heart Association (AHA). The following statement, the responsibility of the NRC, to the best of our knowledge is consistent with the views expressed by representatives of the CDC and the AHA.

STATEMENT

To our knowledge, the use of CPR training manikins has never been documented as being responsible for an outbreak or even an isolated case

of bacterial, fungal, or viral disease. It is our opinion, however, that manikin surfaces may present a risk of disease transmission under some circumstances and that these surfaces should be cleaned and disinfected consistently to minimize this risk.

There are several important infection-control considerations in CPR training. First, the act of mouth-to-mouth or mouth-to-nose artificial respiration obviously requires close physical contact in which a potential rescuer must ignore his or her concerns for personal protection or aesthetic apprehensions to save the life of the victim. Accordingly, in training sessions, students are urged to overcome such hesitation, and they may practice on manikins contaminated by the hands and oral fluids of previous students. This situation becomes especially obvious during the practice of two-rescuer CPR in which the manikin cannot be adequately cleaned between uses by the two students. Second, the practice of removing upper airway obstruction involves sweeping the back of the manikin throat with a finger and, in this situation, contamination from previous students may be smeared on the manikin face. In practice, there is usually no pause at this point to decontaminate the manikin face before beginning mouth-to-mouth breathing. Third, the valve mechanisms and lungs in manikin airways invariably become contaminated during use; if they are not appropriately dismantled and cleaned after class, they may serve as contamination sources for later classes. There is no recognized evidence, however, that the valve mechanisms produce aerosols, even when air is forcibly expelled during chest compression exercises.

Some manufacturers have provided protective face shields for manikins to improve hygienic conditions during training sessions, but such shields are unlikely to be changed after each use by students learning the two-rescuer resuscitation method. Protective shields and detailed instructions for sanitizing the manikins between uses by students and classes are available from several manufacturers.

In the case of potential contamination by microorganisms having either unknown chemical resistance (e.g., microorganisms possibly involved in AIDS) or resistance that has not been fully characterized (e.g., those related to hepatitis and herpesviruses), the manikins pose a difficult disinfection problem. Although several intermediate- to high-strength disinfectants are recommended for use in such contamination as that with hepatitis B, most would be objected to because of material incompatibility with the manikin (e.g., staining or other damage of plastic materials by iodine compounds) or undesirable residues, odors, or toxicities that may affect students (e.g., formaldehyde and glutaraldehyde) when used during training sessions. Alcohols, quaternary ammonium compounds, and phenolics are not generally recommended, because proper contact times for effective action are difficult to achieve (e.g., alcohols evaporate rapidly) or the compounds are not broad-spectrum agents (e.g., quaternary ammonium compounds have only limited action against some viruses and bacteria).

RECOMMENDATIONS

1. Purchasers of training manikins should thoroughly examine the manufacturers' recommendations and provisions for sanitary practices.

2. Students should be told in advance that the training sessions will involve "close physical contact" with their fellow students.

3. Students should not actively participate in training sessions (hands-on training with manikins) if they have dermatologic lesions on hands or in or around the mouth, if they are known to be seropositive for hepatitis B surface antigen (HBsAg), if they have respiratory-tract-infections, if they have AIDS-complex diseases, or if they have reason to believe that they have been exposed to or are in the active stage of any infectious process.

4. If more than one CPR manikin is used in a particular training class, students should be assigned in pairs, and each pair should have contact with only one manikin. This would lessen the likelihood of contamination of several manikins by one student and thus limit possible exposures of other class members.

5. All persons responsible for CPR training should be thoroughly familiar with hygienic concepts (e.g., thorough handwashing before manikin contact and abstinence from eating during class to avoid contamination of manikins with food particles), as well as with the procedures for cleaning and maintaining manikins and accessories (e.g., face shields). Manikins should be inspected routinely for signs of

physical deterioration, such as cracks or tears in plastic surfaces, which make thorough cleaning difficult or impossible. The clothes and hair of manikins should be washed periodically (e.g., monthly) or whenever visibly soiled.

6. During training in two-rescuer CPR, there is no opportunity to disinfect the manikin between students when the switching procedure is practiced. To limit the potential for disease transmission during this exercise, the second student taking over ventilation on the manikin should simulate ventilation instead of blowing into the manikin. This recommendation is consistent with current training recommendations of the American Red Cross and the American Heart Association.

7. In training in the obstructed-airway procedure, the student uses a finger to sweep foreign matter out of the manikin's mouth. This action could contaminate the student's finger with exhaled moisture and saliva from previous students in the same class or contaminate the manikin with material from the student's finger. In practicing this procedure, the finger sweep should either be simulated or be done on a manikin whose airway was decontaminated before the procedure and will be decontaminated after the procedure.

8. At the end of each class, these procedures should be followed as soon as possible to avoid drying of contamination on manikin surfaces:

a. Disassemble manikin as directed by manufacturer.

b. Thoroughly wash all external and internal surfaces (and reusable protective face shields) with warm soapy water and brushes.

c. Rinse all surfaces with fresh water.

d. Wet all surfaces with a sodium hypochlorite solution having at least 500 ppm free available chlorine (1/4 cup liquid household bleach per gallon of tapwater) for 10 minutes. Fresh solution must be made at each class and discarded after each use.

e. Rinse with fresh water and immediately dry all external and internal surfaces; rinsing with alcohol will aid drying of internal surfaces, and this drying will prevent the survival and growth of bacterial or fungal pathogens.

9. Each time a different student uses a manikin in a training class, the protective face shield, if used, should be changed. Between students or after the instructor demonstrates a procedure, such as clearing an obstruction from the airway, the manikin face and inside the mouth should be wiped vigorously with clean absorbent material (e.g., 4" x 4" gauze pad) wet with either the hypochlorite solution described in recommendation No. 8 above or 70% alcohol (isopropyl or ethyl). The surfaces should remain wet for at least 30 seconds and then be wiped dry with a second piece of clean absorbent material.

We are somewhat reluctant to recommend use of alcohol in this instance and do so only as an alternative, because some persons find the odor of hypochlorite objectionable. Although highly bactericidal, alcohols are not considered to be broad-spectrum agents, and their use is recommended primarily as an aid in mechanical cleaning. Furthermore, alcohols may not be effective against bacteria or other pathogens in a short contact period. Nonetheless, little viable microbial

contamination of any kind is likely after vigorous cleaning with alcohol and absorbent material.

10. Persons responsible for the use and maintenance of CPR manikins should be encouraged not to rely totally on the mere presence of a disinfectant to protect them and their students from cross-infection during training programs. Thorough physical cleaning (scrubbing and wiping) should be emphasized as the first step in effective decontamination. Microbial contamination is easily removed from smooth, nonporous surfaces by using disposable cleaning cloths moistened with a detergent solution, and there is no evidence that soaking alone in any liquid is as effective as soaking accompanied by vigorous scrubbing.

11. With specific regard to recent concerns about potential for transmission of hepatitis B and AIDS in CPR training, it has recently been shown that the hepatitis B virus is not as resistant to disinfectant chemicals as was once thought. Current recommendations for strategies dealing with AIDS contamination are the same as those for viral hepatitis B (see bibliography below).

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