



Complete Summary

GUIDELINE TITLE

Guideline for prevention of surgical site infection, 1999.

BIBLIOGRAPHIC SOURCE(S)

Centers for Disease Control and Prevention. Guideline for prevention of surgical site infection, 1999 . Am J Infect Control 1999 Apr; 27(2):97-132. [497 references] [PubMed](#)

Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Hospital Infection Control Practices Advisory Committee. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee . Infect Control Hosp Epidemiol 1999 Apr; 20(4):250-78; quiz 279-80. [497 references] [PubMed](#)

COMPLETE SUMMARY CONTENT

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SCOPE

DISEASE/CONDITION(S)

Surgical site infections

GUIDELINE CATEGORY

Prevention

CLINICAL SPECIALTY

Anesthesiology
Infectious Diseases
Pathology
Surgery

INTENDED USERS

Advanced Practice Nurses
Hospitals
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

- To provide recommendations for the prevention of surgical site infections
- To update and replace previous guidelines for prevention of surgical site infections (SSI).

TARGET POPULATION

Adults undergoing an open surgical procedure in an operating room.

INTERVENTIONS AND PRACTICES CONSIDERED

- A. Preoperative measures:
 1. Preparation of patient
 2. Hand/forearm antisepsis for surgical team members
 3. Management of infected or colonized surgical personnel
 4. Antimicrobial prophylaxis
- B. Intraoperative measures:
 1. Ventilation including appropriate number of air changes per hour, filtration, limitations on opening operating room doors, and limitations on personnel and equipment entering room
 2. Cleaning and disinfection of environmental surfaces during operative procedure using EPA-approved hospital disinfectant
 3. Microbiologic sampling of operating room, as part of epidemiologic investigation
 4. Sterilization of surgical instruments
 5. Appropriate surgical attire and drapes including a cap or hood to cover hair, sterile gloves, surgical gowns and drapes that are effective barriers when wet
 6. Asepsis and surgical technique
- C. Postoperative incision care
- D. Surveillance of surgical site infections

MAJOR OUTCOMES CONSIDERED

Incidence of surgical site infections.

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review
Review of Published Meta-Analyses

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

"Recommendations for Prevention of Surgical Site Infection," represents the consensus of the Hospital Infection Control Practices Advisory Committee (HICPAC) regarding strategies for the prevention of surgical site infections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Category I A. Strongly recommended for all hospitals and strongly supported by well-designed experimental or epidemiologic studies.

Category I B. Strongly recommended for all hospitals and viewed as effective by experts in the field and a consensus of Hospital Infection Control Practices Advisory Committee (HICPAC), based on strong rationale and suggestive evidence, even though definitive scientific studies may not have been done.

Category II. Suggested for implementation in many hospitals. Recommendations may be supported by suggestive clinical or epidemiologic studies, a strong theoretical rationale, or definitive studies applicable to some, but not all, hospitals.

No recommendation; unresolved issue. Practices for which insufficient evidence or consensus regarding efficacy exist.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Not stated

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Please note: June 6, 2003 [Guidelines for Environmental Infection Control in Health-Care Facilities. Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee \(HICPAC\)](#), published by the Centers for Disease Control and Prevention (CDC) updates operating room ventilation and surface cleaning/disinfection recommendations from the section in this guideline titled "Intraoperative Issues: Operating Room Environment."

Categories of recommendations (IA, IB, II, Unresolved issue, and *) are defined at the end of the Major Recommendations field.

1. Preoperative
 - a. Preparation of the patient
 1. Whenever possible, identify and treat all infections remote to the surgical site before elective operation and postpone elective operations on patients with remote site infections until the infection has resolved. Category IA
 2. Do not remove hair preoperatively unless the hair at or around the incision site will interfere with the operation. Category IA
 3. If hair is removed, remove immediately before the operation, preferably with electric clippers. Category IA
 4. Adequately control serum blood glucose levels in all diabetic patients and particularly avoid hyperglycemia perioperatively. Category IB
 5. Encourage tobacco cessation. At minimum, instruct patients to abstain for at least 30 days before elective operation from

- smoking cigarettes, cigars, pipes, or any other form of tobacco consumption (e.g., chewing/dipping). Category IB
6. Do not withhold necessary blood products from surgical patients as a means to prevent surgical site infections (SSI). Category IB
 7. Require patients to shower or bathe with an antiseptic agent on at least the night before the operative day. Category IB
 8. Thoroughly wash and clean at and around the incision site to remove gross contamination before performing antiseptic skin preparation. Category IB
 9. Use an appropriate antiseptic agent for skin preparation. Category IB
 10. Apply preoperative antiseptic skin preparation in concentric circles moving toward the periphery. The prepared area must be large enough to extend the incision or create new incisions or drain sites, if necessary. Category II
 11. Keep preoperative hospital stay as short as possible while allowing for adequate preoperative preparation of the patient. Category II
 12. No recommendation to taper or discontinue systemic steroid use (when medically permissible) before elective operation. Unresolved issue
 13. No recommendation to enhance nutritional support for surgical patients solely as a means to prevent SSI. Unresolved issue
 14. No recommendation to preoperatively apply mupirocin to nares to prevent SSI. Unresolved issue
 15. No recommendation to provide measures that enhance wound space oxygenation to prevent SSI. Unresolved issue
- b. Hand/forearm antisepsis for surgical team members
 1. Keep nails short and do not wear artificial nails. Category IB
 2. Perform a preoperative surgical scrub for at least 2 to 5 minutes using an appropriate antiseptic. Scrub the hands and forearms up to the elbows. Category IB
 3. After performing the surgical scrub, keep hands up and away from the body (elbows in flexed position) so that water runs from the tips of the fingers toward the elbows. Dry hands with a sterile towel and don a sterile gown and gloves. Category IB
 4. Clean underneath each fingernail prior to performing the first surgical scrub of the day. Category II
 5. Do not wear hand or arm jewelry. Category II
 6. No recommendation on wearing nail polish. Unresolved Issue
 - c. Management of infected or colonized surgical personnel
 1. Educate and encourage surgical personnel who have signs and symptoms of a transmissible infectious illness to report conditions promptly to their supervisory and occupational health service personnel. Category IB
 2. Develop well-defined policies concerning patient-care responsibilities when personnel have potentially transmissible infectious conditions. These policies should govern (a) Personnel responsibility in using the health service and reporting illness, (b) work restrictions, and (c) clearance to resume work after an illness that required work restriction. The

- policies also should identify persons who have the authority to remove personnel from duty. Category IB
3. Obtain appropriate cultures from, and exclude from duty, surgical personnel who have draining skin lesions until infection has been ruled out or personnel have received adequate therapy and infection has resolved. Category IB
 4. Do not routinely exclude surgical personnel who are colonized with organisms such as *S. aureus* (nose, hands, or other body site) or group A *Streptococcus*, unless such personnel have been linked epidemiologically to dissemination of the organism in the healthcare setting. Category IB
- d. Antimicrobial prophylaxis
1. Administer a prophylactic antimicrobial agent only when indicated, and select it based on its efficacy against the most common pathogens causing SSI for a specific operation and published recommendations (Anonymous, 1997; Nichols, 1989; Ehrenkranz, 1993; Trilla & Mensa, 1993; Ehrenkranz & Meakins, 1992; Nichols, 1995). Category IA
 2. Administer by the intravenous route the initial dose of prophylactic antimicrobial agent, timed such that a bactericidal concentration of the drug is established in serum and tissues when the incision is made. Maintain therapeutic levels of the agent in serum and tissues throughout the operation and until, at most, a few hours after the incision is closed in the operating room. Category IA
 3. Before elective colorectal operations in addition to d2 above, mechanically prepare the colon by use of enemas and cathartic agents. Administer nonabsorbable oral antimicrobial agents in divided doses in the day before the operation. Category IA
 4. For high-risk cesarean section, administer the prophylactic antimicrobial agent immediately after the umbilical cord is clamped. Category IA
 5. Do not routinely use vancomycin for antimicrobial prophylaxis. Category IB
2. Intraoperative
- a. Ventilation
 1. Maintain positive-pressure ventilation in the operating room with respect to the corridors and adjacent areas. Category IB
 2. Maintain a minimum of 15 air changes per hour, of which at least 3 should be fresh air. Category IB
 3. Filter all air, recirculated and fresh, through the appropriate filters per the American Institute of Architects' recommendations (American Institute of Architects, 1996). Category IB
 4. Introduce all air at the ceiling, and exhaust near the floor. Category IB
 5. Do not use UV radiation in the operating room to prevent SSI. Category IB
 6. Keep operating room doors closed except as needed for passage of equipment, personnel, and the patient. Category IB
 7. Consider performing orthopedic implant operations in operating rooms supplied with ultraclean air. Category II

8. Limit the number of personnel entering the operating room to necessary personnel. Category II
- b. Cleaning and disinfection of environmental surfaces
 1. When visible soiling or contamination with blood or other body fluids of surfaces or equipment occurs during an operation, use and EPA-approved hospital disinfectant to clean the affected areas before the next operation. Category IB*
 2. Do not perform special cleaning or closing operating rooms after contaminated or dirty operations. Category IB
 3. Do not use tacky mats at the entrance to the operating room suite or individual operating rooms for infection control. Category IB
 4. Wet vacuum the operating room floor after the last operation of the day or night with an EPA-approved hospital disinfectant. Category II
 5. No recommendation on disinfecting environmental surfaces or equipment used in operating rooms between operations in the absence of visible soiling. Unresolved issue
 - c. Microbiologic sampling
 1. Do not perform routine environmental sampling of the operating room. Perform microbiologic sampling of operating room environmental surfaces or air only as part of an epidemiologic investigation. Category IB
 - d. Sterilization of surgical instruments
 1. Sterilize all surgical instruments according to published guidelines (Association of Operating Room Nurses, 1999; American Institute of Architects, 1996; Favero & Bond, 1991; Association for the Advancement of Medical Instrumentation, 1996). Category IB
 2. Perform flash sterilization only for patient care items that will be used immediately (e.g., to reprocess an inadvertently dropped instrument). Do not use flash sterilization for reasons of convenience, as an alternative to purchasing additional instrument sets, or to save time. Category IB
 - e. Surgical attire and drapes
 1. Wear a surgical mask that fully covers the mouth and nose when entering the operating room if an operation is about to begin or already under way, or if sterile instruments are exposed. Wear the mask throughout the operation. Category IB*
 2. Wear a cap or hood to fully cover hair on the head and face when entering the operating room. Category IB*
 3. Do not wear shoe covers for the prevention of SSI. Category IB*
 4. Wear sterile gloves if a scrubbed surgical team member. Put on gloves after donning a sterile gown. Category IB*
 5. Use surgical gowns and drapes that are effective barriers when wet (i.e., materials that resist liquid penetration). Category IB*
 6. Change scrub suits that are visibly soiled, contaminated, and/or penetrated by blood or other potentially infectious materials. Category IB*
 7. No recommendations on how or where to launder scrub suits, on restricting use of scrub suits to the operating suite, or for

covering scrub suits when out of the operating suite.
Unresolved issue

- f. Asepsis and surgical technique
 1. Adhere to principles of asepsis when placing intravascular devices (e.g., central venous catheters), spinal or epidural anesthesia catheters, or when dispensing and administering intravenous drugs. Category IA
 2. Assemble sterile equipment and solutions immediately prior to use. Category II
 3. Handle tissue gently, maintain effective hemostasis, minimize devitalized tissue and foreign bodies (i.e., sutures, charred tissues, necrotic debris), and eradicate dead space at the surgical site. Category IB
 4. Use delayed primary skin closure or leave an incision open to heal by second intention if the surgeon considers the surgical site to be heavily contaminated (e.g., Class III and Class IV). Category IB
 5. If drainage is necessary, use a closed suction drain. Place a drain through a separate incision distant from the operative incision. Remove the drain as soon as possible. Category IB
3. Postoperative incision care
 - a. Protect with a sterile dressing for 24 to 48 hours postoperatively an incision that has been closed primarily. Category IB
 - b. Wash hands before and after dressing changes and any contact with the surgical site. Category IB
 - c. When an incision dressing must be changed, use sterile technique. Category II
 - d. Educate the patient and family regarding proper incision care, symptoms of SSI, and the need to report such symptoms. Category II
 - e. No recommendation to cover an incision closed primarily beyond 48 hours, nor on the appropriate time to shower or bathe with an uncovered incision. Unresolved issue
4. Surveillance
 - a. Use CDC definitions of SSI without modification for identifying SSI among surgical inpatients and outpatients. Category IB
 - b. For inpatient case-finding (including readmissions), use direct prospective observation, indirect prospective detection, or a combination of both direct and indirect methods for the duration of the patient's hospitalization. Category IB
 - c. When postdischarge surveillance is performed for detecting SSI following certain operations (e.g., coronary artery bypass graft), use a method that accommodates available resources and data needs. Category II
 - d. For outpatient case-finding, use a method that accommodates available resources and data needs. Category IB
 - e. Assign the surgical wound classification upon completion of an operation. A surgical team member should make the assignment. Category II
 - f. For each patient undergoing an operation chosen for surveillance, record those variables shown to be associated with increased SSI risk (e.g., surgical wound class, ASA class, and duration of operation). Category IB

- g. Periodically calculate operation-specific SSI rates stratified by variables shown to be associated with increased SSI risk (e.g., National Nosocomial Infections Surveillance [NNIS] risk index). Category IB
- h. Report appropriately stratified, operation-specific SSI rates to surgical team members. The optimum frequency and format for such rate computations will be determined by stratified case-load sizes (denominators) and the objectives of local, continuous quality improvement initiatives. Category IB
- i. No recommendation to make available to the infection control committee coded surgeon-specific data. Unresolved issue

Definitions

Category IA. Strongly recommended for all hospitals and strongly supported by well-designed experimental or epidemiologic studies.

Category IB. Strongly recommended for all hospitals and viewed as effective by experts in the field and a consensus of Hospital Infection Control Practices Advisory Committee (HICPAC), based on strong rationale and suggestive evidence, even though definitive scientific studies may not have been done.

Category II. Suggested for implementation in many hospitals. Recommendations may be supported by suggestive clinical or epidemiologic studies, a strong theoretical rationale, or definitive studies applicable to some, but not all, hospitals.

No recommendation; unresolved issue. Practices for which insufficient evidence or consensus regarding efficacy exist.

Practices required by federal regulation are denoted with an asterisk (*).

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

[References open in a new window](#)

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on data from well-designed scientific studies, whenever possible. However, some of the recommendations are based on a strong theoretical rationale and suggestive evidence in the absence of confirmatory scientific knowledge.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

A reduction in the risk of surgical site infections (SSI).

Subgroups Most Likely to Benefit:

Patient characteristics possibly associated with an increased risk of a surgical site infection in certain kinds of operations, include coincident remote site infections or colonization, diabetes, cigarette smoking, systemic steroid use, obesity (>20% ideal body weight), extremes of age, poor nutritional status, and altered immune response.

POTENTIAL HARMS

Not stated

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

RELATED NQMC MEASURES

- [Surgical infection prevention: percent of patients who received prophylactic antibiotics within 1 hour prior to surgical incision.](#)
- [Surgical infection prevention: percent of patients who received prophylactic antibiotics consistent with current guidelines.](#)
- [Surgical infection prevention: percent of patients whose prophylactic antibiotics were discontinued within 24 hours after surgery end time.](#)

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Centers for Disease Control and Prevention. Guideline for prevention of surgical site infection, 1999 . Am J Infect Control 1999 Apr; 27(2):97-132. [497 references] [PubMed](#)

Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Hospital Infection Control Practices Advisory Committee. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee . Infect Control Hosp Epidemiol 1999 Apr; 20(4):250-78; quiz 279-80. [497 references] [PubMed](#)

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999 Apr

GUIDELINE DEVELOPER(S)

Centers for Disease Control and Prevention - Federal Government Agency [U.S.]

SOURCE(S) OF FUNDING

United States Government

GUIDELINE COMMITTEE

Hospital Infection Control Practices Advisory Committee (HICPAC)

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of the CDC, Hospital Infections Program staff members who prepared this report: Alicia J. Mangram, MD; Teresa C. Horan, MPH; Leah Christine Silver, BS; William R. Jarvis, MD.

Names of Committee Members, January 1999: Elaine L. Larson, RN, PhD, FAAN, CIC (Chairman); Michele L. Pearson, MD; James T. Lee, MD, PhD, FACS; Audrey B. Adams, RN, MPH; Raymond Y.W. Chinn, MD; Alfred DeMaria Jr, MD; Susan W. Forlenza, MD; Ramon E. Moncada, MD; William E. Scheckler, MD; Jane D. Siegel, MD; Marjorie A Underwood, RN, BSN, CIC; Robert A. Weinstein, MD.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline. This guideline updates previously issued recommendations. (Garner JS. CDC guideline for prevention of surgical

wound infections, 1985. Infect Control 1986:7[3]:193-200. Simmons BP. Guideline for prevention of surgical wound infections. Infect Control 1982:3:185-196.)

An update is not in progress at this time.

GUIDELINE AVAILABILITY

Electronic copies: Available from the [Centers for Disease Control and Prevention, Hospital Infection Programs \(HIP\) Web site](#).

Print copies: Available from the Centers for Disease and Control Prevention, Hospital Infections Program, Mailstop E-69, 1600 Clifton Rd, NE, Atlanta, GA 30333; (404) 639-6101. Additional copies can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325; (202) 783-3238.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on March 13, 2000. The information was verified by the guideline developer on May 12, 2000.

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