

Infection Control Resource

Vol. 2 No.1

Prevention Strategies for IC Practitioners and Professional Nurses

In this issue

Surgical site infections (SSIs) are a substantial cause of morbidity and mortality among hospitalized patients. They are the third most commonly reported nosocomial infection and account for 14% to 16% of all nosocomial infections. Costs to treat them continue to escalate. Some financial challenges related to the treatment of nosocomial SSIs include increased length of stay, readmissions, costly treatment and systemic antibiotics, and antibiotic-resistant bacteria. Despite advances in infection control practices, the evidence continues to grow regarding the morbidity of SSIs. Ms. Tomaselli, a wound care specialist, discusses appropriate techniques to prevent infection and appropriate modalities to treat SSIs.

Patients with tubes and drains are at risk for urinary tract infections, pneumonia, and surgical-site infections. Urinary tract infections (UTIs) account for the majority of all nosocomial infections. Patients who have intubation of the respiratory tract, nasogastric tubes, endotracheal tubes, or tracheostomies have a higher risk for pneumonia, which is the second most common nosocomial infection. Ms. Scardillo, an expert in the management of tubes and drains, will review common drains and tubes, discuss key points about their usage and care, and recommend strategies for the prevention of nosocomial infection associated with tubes and drains.

Advisory Board

Susan Slavish, RN, BSN, MPH, CIC
Infection Control, Queen's Medical Center
Honolulu, HI

Elaine Flanagan, BSN, MSA, CIC
Manager Epidemiology
Detroit Medical Center, Detroit, MI

Barbara Debaun, RN, BSN, CIC
Director, Infection Control
California Pacific Medical Center, San Francisco, CA

Gwen Beiningen, RN, MS, CIC
Infection Control Coordinator
Sioux Valley Hospitals & Health Systems
Sioux Falls, SD

Gail Bennett, RN, MSN, CIC
Associate Executive Director,
ICP Associates, Rome, GA

Nancy Bjerke, RN, MPH, CIC
Infection Control Associates
San Antonio, TX

Prevention and treatment of surgical-site infections

by Nancy Tomaselli, RN, MSN, CS, CRNP, CWOCN, CLNC

There are approximately 27 million surgical procedures performed in the United States each year. Based on reports from the National Nosocomial Infections Surveillance (NNIS) system of the Centers for Disease Control and Prevention (CDC), surgical-site infections (SSIs) are the third most frequently reported nosocomial infection. Of these SSIs, two thirds are confined to the incision, and one third are confined to organs or spaces accessed during the operation.¹

Costs associated with SSIs

There are several financial challenges related to the treatment of nosocomial SSIs including increased length of stay, readmissions, costly treatment and systemic antibiotics, and antibiotic-resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE). The literature reveals that increased length of stay and costs are associated with SSIs.³ Deep SSIs involving organs or spaces have an even greater length of stay and cost than SSIs confined to the incision.

Despite advances in infection control practices, the evidence continues to grow regarding the morbidity of SSIs, with an added cost of over 3 thousand dollars per infection.² The impact on patient care must also be considered. Patients have a 60% chance of spending days in the ICU, are 5 times more likely to be readmitted to the hospital, and face 2 times more likelihood of mortality.³

Surgical-site infections defined

According to the NNIS system, SSIs can be defined as superficial incisional, deep incisional, or organ/space infections.⁴ Specific definitions for each are outlined below.

Superficial incisional infections

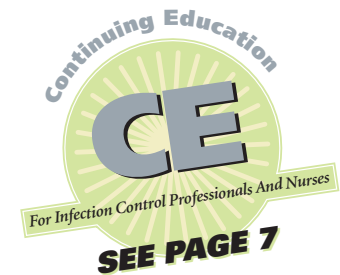
Superficial incisional infections occur within 30 days after surgery, and infection involves skin or subcutaneous tissue and at least one of the following:

- purulent drainage
- positive culture from wound fluid
- at least one sign of infection (pain or tenderness, localized swelling, redness, or heat) and the incision is superficially opened by a physician, unless the incision is culture-negative
- diagnosis of superficial incisional SSI by a physician

Deep incisional infections

Deep incisional SSIs occur within 30 days after surgery if no implant is left in place, or within 1 year if an implant is left in place and the infection appears to be related to the operation. The infection involves deep soft tissues of the incision and at least one of the following:

- purulent drainage from the deep incision but not from the organ/space component of the surgical site
- the incision spontaneously dehisces or is deliberately opened by a surgeon when a



Continued on page 4

Managing tubes and drains: Considerations for infection control

by Jody Scardillo, RN, MS, CWOCN

Two million people develop nosocomial infections every year¹ – a 36% increase in the past 20 years.² The four most common infections are urinary tract infections, related to intravascular devices, pneumonia, and surgical-site infections. Of particular importance to patients with tubes and drains are urinary tract infections, pneumonia, and surgical-site infections.

Urinary tract infections (UTIs) account for 36 to 40% of all nosocomial infections.² Nosocomial UTIs increase hospital length of stay by 3 to 4 days and cost almost \$4000 per infection.² Pneumonia is the second most common nosocomial infection (13 to 18%).² Patients who have intubation of the respiratory tract, nasogastric tubes, endotracheal tubes, or tracheostomies have a higher risk of nosocomial infection. On average, pneumonia adds 6 days to hospitalization at a cost of about \$5600.² Surgical-site infections (SSI) account for 30 to 40% of all nosocomial infections. SSI lengthen a hospital stay by 7.3 days at a cost of \$3152.²

Although infection-control practitioners (ICPs) may not provide hands-on care for patients with drains or tubes, their expertise ensures a positive outcome. This article will review common drains and tubes, discuss key points about their usage and care, and focus on strategies for the prevention of nosocomial infection.

Placement and removal

Drains are used for a variety of procedures including abdominal surgeries, myocutaneous flap surgery, breast surgery, and orthopedic procedures. Surgical drains are indicated in abdominal surgery for decompression; in any area with a large potential dead space, the presence of infected or necrotic tissue, or uncertain hemostasis; or in any area with a fistula.³ When drains are

placed through an incision, they increase the risk of infection, so experts suggest placing them away from incisions.⁴ Drainage is initially sanguinous or serosanguinous, depending on the site of surgery. The volume and character of drainage are considered before drain removal.

Drains left in place for extended periods are associated with higher rates of infection and pressure necrosis in surrounding structures.³ The rate of complications increases with the length of time that the drain remains.³ Ingrowth of surrounding tissue can make these drains difficult to remove.

Types of drains

Active drains use a negative-pressure system, created by a compressible reservoir. Tube diameter and length, the consistency of fluid drainage, and the amount of negative pressure determine the effectiveness of an active drain.⁵ This drain allows reliable measurement and assessment of the character of drainage, minimizes tissue trauma, and decreases the risk of infection as compared to a passive drain. Jackson-Pratt and Hemovac drains are common examples of versatile active drains used after many types of surgery.

Passive drains, such as the Penrose, depend on gravity. To function, they require an external tract. Made of a soft, flat, flexible latex, they are sutured in place to prevent accidental dislodgement. Placement of a safe-



Figure 1. Excilon® Drain Sponge

ty pin through the drain prevents migration into the wound. As passive drains need a dressing to contain drainage, it can be difficult to quantify output. These drains are used when drainage is too viscous to pass through tubular drains.⁴ An ostomy pouching system can be used to manage large volumes of drainage; it can help to quantify output and protect the patient's skin.

Sump drains are double-lumen tubes with a small inflow lumen and large outflow lumen. Venting occurs when air enters the draining area through the inflow lumen. The air breaks the vacuum and displaces air or fluid into the larger outflow lumen. Some types have a third lumen that can be used for instillation of an irrigating solution. These tubes are usually placed intra-operatively and are connected to low continuous or intermittent suction. A sucking sound will be heard if the air vent is patent.

Percutaneous drainage catheters provide continuous fluid drainage. The catheter is inserted under imaging guidance in sterile conditions, allowing for precise localization of a fluid collection or abscess in many organ systems and better positioning of the catheter(s) to facilitate drainage. This treatment has decreased morbidity and mortality and reduced hospital length of stay.⁶ Indications for percutaneous drainage are suspicion that a fluid collection is infected, a need to characterize the fluid collection, or the patient is symptomatic. Complications include sepsis, bacteremia, hemorrhage, and bowel or pleural transgression.⁶ The patient's response, volume of drainage, and complexity of condition determine the length of time that drainage is necessary.

Tracheostomy tubes are inserted through a tracheostomy, an airway-tract stoma, by traditional surgical or percutaneous techniques. These tubes are used for pulmonary toilet and airway secretion management, prolonged airway maintenance with and without mechanical ventilation, prevention of aspiration pneumonia, and to treat upper airway obstruction. They can be temporary or permanent measures. The person with a tracheostomy is at risk for local infection, peritubular skin breakdown, tracheal stenosis, tracheo-esophageal fistula, aspiration, accidental dislodgement, and an altered ability for verbal communication.⁷

Leakage of secretions around the tracheostomy tube can cause local skin ir-

ritation. Adequate secretion management and suctioning will assist in minimizing this problem. An extra tube and obturator should be kept at the bedside in case of accidental dislodgement. A disposable inner cannula, if used, must be replaced daily.⁷ The tracheostomy tube should be changed using the aseptic technique to lessen the risk of infection.

Chest tubes are used to drain the chest after surgery, some types of trauma, and fluid collections. A closed system is used to prevent the incursion of atmospheric pressure. Closed systems promote the evacuation of air and serosanguinous fluid from the pleural space, help to re-expand the lung by re-establishing negative pressure in the pleural space, and prevent mediastinal shift and pneumothorax in the postoperative patient.⁸

Disposable chest drainage systems have three chambers. A collection chamber allows for visualization of the amount and character of drainage. The water-seal chamber has a one-way valve, so that air or fluid can drain from the chest without backflow. A vent allows air from the pleural space to exit. The suction-control chamber uses suction to promote drainage and lung re-expansion. Suction is commonly used with 10 to 20 cm of water. Connections between tube and collection system must be airtight to prevent air leakage into the pleural space during inspiration.

A more recent technique is the use of a pigtail chest tube. Placed by an interventional radiologist, this tube is significantly smaller than traditional chest tubes, so it is more comfortable for patients. Like a standard chest tube, this tube is also connected to a closed system.

Nephrostomy tubes provide urinary drainage through the renal pelvis via an opening in the skin over the flank. These tubes are indicated in the management of kidney stones and biopsies, for stricture dilatation, and to enable leaks or fistulas in the ureters or urethra to heal.⁹ In the presence of strictures and calculi, the nephrostomy tube is usually a temporary device. Its use is indefinite in patients with an obstructing tumor.¹⁰

Complications of nephrostomy tube placement can include hemorrhage, clot formation, infection, obstruction, or dislodgement.^{11,12} Infection can be prevented by regularly changing the catheter, keep-

Patients who have intubation of the respiratory tract, nasogastric tubes, endotracheal tubes, or tracheostomies have a higher risk of nosocomial infection.

On average, pneumonia adds 6 days to hospitalization at a cost of about \$5600.

ing skin around the tube clean and dry, and maintaining a dry, secure bandage. Symptoms of tube obstruction are leakage of urine around the tube, absence of urine drainage, and back pain.

Biliary catheters are soft, thin, rubber tubes that pass through the skin and liver into the bile duct to promote bile drainage. An interventional radiologist or surgeon places the tube, which is indicated for temporary drainage of bile before or after surgery, to relieve blockage of the bile ducts, or to bypass a hole in the bile duct.

Healthcare workers instruct the patient to notify them of fever, chills, bile leakage around the tube, bleeding in or around the tube, or a broken or dislodged tube. If the patient develops difficulty with periodic irrigation, the healthcare worker should be notified.¹³

Skin care

The skin should be kept as clean and dry as possible. It should be routinely observed for erythema, tenderness, or irritation. Whenever skin integrity is disrupted, the patient is at risk for infection and other complications. Important nursing measures in caring for patients with drainage tubes are good site care, careful monitoring for infection, and adequate stabilization of the

tube/drain, so that it can work properly.

Protection of the skin from exposure to caustic drainage is an important consideration. The potential for skin damage depends on the type and amount of drainage and presence of leakage around the tube.

Skin barriers can be used to prevent or treat irritated skin. They are available as liquids, wipes, or creams. The surrounding skin must be cleansed and gently pat dry before the barrier is applied, according to manufacturer's directions.

Dry gauze dressings are used around and over drainage tubes to protect the tube, absorb small amounts of drainage, assist with tube stabilization, and help to protect from external contamination. One- or two-piece ostomy appliances can be used to contain larger volumes of drainage.

Fenestrated gauzes or drainage sponges are available from many manufacturers. These devices can help to prevent cut gauze fibers from entering a tracheostomy. Foam dressings are effective for absorbing drainage and do not adhere to peri-wound skin. They are permeable, easily conformable, and help to reduce maceration by absorbing moisture. They are available in adhesive or non-adhesive forms and are easy for caregivers to use.

A recent development is the use of drainage sponges that contain the broad-spectrum antimicrobial component polyhexamethylene biguanide (PHMB) (Excilon® A.M.D., Tyco Healthcare Group LP). Standard gauzes do not act as a barrier to bacteria because of their porous structure. However, Excilon AMD sponge functions as a bacterial barrier as a result of PHMB's ability to resist bacterial colonization and bacterial penetration. PHMB is effective against gram-positive and -negative organisms, yeast and fungi, including methicillin-resistant *Streptococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE). Because Excilon A.M.D. sponge appears and functions like a standard sponge, there is no need to change clinical protocols (figure. 1).

Key points for infection-control practitioners

Common pathogens

E. coli, enterococcus, and klebsiella are the most common pathogens in nosocomial UTI. Pneumonia is most often caused by

Continued on page 6

Prevention and treatment of surgical-site infections — Continued from page 1

patient has fever and/or localized pain and/or tenderness, unless the site is culture-negative

- an abscess or other evidence of infection involving the deep incision is found on direct examination, during re-operation, or by histopathologic or radiologic examination
- diagnosis of deep incisional SSI by a physician

Organ/space SSIs

Organ/space SSIs occur within 30 days after surgery if no implant is left in place or within 1 year if an implant is in place and the infection appears to be related to the operation. The infection involves any part of the anatomy other than the incision, which was opened or manipulated during an operation, and at least one of the following:

- purulent drainage from a drain that is placed through a stab wound into the organ/space
- organisms isolated from fluid or tissue in the organ/space
- an abscess or other evidence of infection involving the organ/space is found on direct examination, during re-operation, or by histopathologic or radiologic examination.
- diagnosis of an organ/space SSI by a physician

Risk factors associated with SSIs

Several factors contribute to the development of SSIs. These include patients who are elderly, immunocompromised, malnourished, diabetic with increased glucose levels (>200 mg/dL) in the immediate postoperative period, obese, or smokers. In addition, prolonged preoperative hospitalization, preoperative nares colonization with *Staphylococcus aureus*, and perioperative transfusions can also increase the risk for SSIs.¹

SSIs are most commonly caused by *Staphylococcus aureus*, coagulase-negative staphylococcus, *Enterococcus*, and *Escherichia coli*. For the majority of SSIs, the pathogens are endogenous flora of the patient's skin, mucous membranes, or hollow viscera. The endogenous organisms are

Patients have a 60% chance of spending days in the ICU, are 5 times more likely to be readmitted to the hospital, and face 2 times more likelihood of mortality.

usually aerobic gram-positive cocci but can also be fecal flora if incisions are made near the perineum or groin. Exogenous sources also contribute to SSIs and include surgical personnel, the operating room environment, and all tools, instruments, or materials on the sterile field during the operation.¹ Exogenous bacteria are primarily aerobes such as staphylococci and streptococci.

Variables known to affect the bacterial burden and to increase the risk for infection are the number of microorganisms in the wound, the bacterial virulence, and host resistance factors, as represented by the following equation:¹

$$\text{Risk for wound infection} = \text{bacterial dose} \times \text{virulence} / \text{host resistance}$$

Clinical infection in surgical sites

Acute wounds are susceptible to bacterial invasion by skin flora that can cause wounds such as grafts and flaps to fail and can lead to sepsis if untreated. The risk for infection is determined by several factors including the wound type, the number and type of organisms present, and patient comorbidities. The patient's immune function and local host defenses must also be considered. When host and wound conditions are favorable, infection can occur.

Three levels of bacteria can occur in a wound: contamination, colonization, and infection. It is generally accepted that all wounds are contaminated. Contamination is characterized by the presence, but not proliferation, of bacteria in the wound. Colonization is characterized by proliferation of bacteria in a wound without a host

response, and may delay the healing process. Infection occurs when bacteria invade healthy tissues, continue to proliferate, and overwhelm the host immune response. Classic signs of infection are local redness, pain and swelling, changes in the amount and character of exudate, and fever. A concentration of 10⁵ bacteria per gram of tissue indicates a clinical infection.^{1,5,6}

In acute wounds that heal by primary intention, exudate from the incision line occurs during the first 48–72 hours. The presence of exudate after that time is a sign of impaired healing that is most likely secondary to infection. Wound exudate is important to assess because its characteristics help the healthcare provider not only to diagnose wound infection but also to evaluate the effectiveness of therapy and to monitor wound healing. In an infected wound, exudate is usually purulent and increases to moderate or large amounts. The exudate drains valuable substrates, such as growth factors, from the wound bed and impairs the wound healing process.

Prevention strategies for SSIs

The CDC recommendations for the prevention of surgical-site infections can be found in "Guideline for Prevention of Surgical Site Infection, 1999."¹ There is a limited number of studies that concisely validate risk factors and prevention measures for SSIs; therefore, some of the recommendations for prevention are based on theory and suggestive evidence in the absence of scientific knowledge.

Preoperative

The CDC makes the following recommendations regarding antimicrobial prophylaxis:¹

- Administer agents only when indicated, and select agents based on efficacy against the most common pathogens causing the SSI for a specific operation.
- Administer the initial dose intravenously, timed so that a bactericidal concentration of the drug is established in serum and tissues when the incision is made. Maintain therapeutic levels throughout the operation and a few hours after the incision is closed.
- Before elective colorectal operations, also prepare the colon with enemas and cathartic agents. On the day be-

fore the operation, administer non-absorbable oral antimicrobial agents in divided doses.

- For high-risk caesarean section, administer the agent immediately after the umbilical cord is clamped.
- Do not routinely use vancomycin for antimicrobial prophylaxis.

Postoperative

The CDC recommends that sterile techniques and supplies be used for any type of surgical incision.¹ Care of the postoperative incision varies depending on whether the incision is closed by primary or secondary intention. Most surgical incisions are closed primarily and are covered with a sterile dressing for 24–48 hours. After 48 hours, it is unclear whether a dressing is necessary or if showering or bathing is detrimental to healing. When an incision is left open for a few days before it is closed, or when an incision is left open to heal by secondary intention, the incision is packed with a sterile dressing; a dressing with adhesive borders and a polymer film component can be used. Some dressings can provide a physical barrier to bacteria entering the wound; however, standard gauze dressing does not provide a bacterial barrier. Bacteria can also be introduced into the wound with poor dressing change technique.

Attempts to control infection in the wound bed present challenges to wound healing. Healthcare providers must be cognizant of chemicals and techniques used to prevent infection. One of the most effective preventive measures is debridement of devitalized tissue, and necrotic debris must also be removed before topical antibiotics can be used. Another preventive measure is cleansing with nontoxic solutions and adequate force. Bacteria cannot invade healthy tissue until they attach to the wound bed, and wound cleansing physically removes surface bacteria. The solution used does not require an antiseptic agent. Normal saline is effective when used with adequate force to wash away the bacteria. Studies have shown that a 35-mL syringe and a 19-gauge needle deliver the solution at 8 psi, adequate to remove bacteria.⁶

The role of antimicrobials in SSIs Antibiotics

The efficacy of antibiotic use has been eroded by resistant organisms, putting



Figure 1. Kerlex AMD Bandage

years of medical milestones in antimicrobial therapy at risk. Resistance to penicillin has increased from 5% to 90% since its introduction in 1944.^{5,7} This problem was overcome in the 1960s with the introduction of methicillin. Shortly after, the first methicillin-resistant *Staphylococcus aureus* (MRSA) developed. There followed a series of epidemic MRSA strains that were susceptible to only glycopeptides, vancomycin, and teicoplanin. In turn, the increased administration of antibiotics to treat patients infected with MRSA led to a rise in vancomycin-resistant organisms, resulting in vancomycin-resistant enterococci (VRE).

Antimicrobial dressings

Because of the continuing resistance to oral antibiotics, it is clear that alternative methods for treating wound infections are essential. Aerobes and anaerobes can produce a synergistic pathogenic effect resulting in an increased risk for infection. Antimicrobial dressings with broad-spectrum activity are alternative methods for fighting antibiotic-sensitive and-resistant wound pathogens. These dressings inhibit growth of pathogens, especially antibiotic-resistant strains. They provide substantial benefit to the patient and the hospital by inhibiting the spread of resistant organisms and reducing costs associated with wound infections. These antimicrobial dressings are indicated for mild wound infections only, not cellulitis.

The use of topical antibiotics and antiseptics is a key approach for reducing the microbial load in wounds. There are several commercially available topical formulas

that release antimicrobial agents into the wound bed. Commonly used antibiotics include bacitracin, mupirocin (e.g., Bactroban), and triple-antibiotic cream (neomycin, polymyxin, and bacitracin) such as Neosporin. Mupirocin is a specific topical agent for wounds infected with MRSA. However, due to the increasing incidence of bacterial resistance, antibiotics are being used less frequently. Antiseptic agents such as slow-release iodine (cadexomer iodine paste) and silver ions (silver sulphadiazine cream) have the advantage of rarely inducing bacterial resistance. In addition, some recently introduced dry dressings (traditional gauze) and moist wound-healing dressings (hydrocolloid, alginate, hydrofiber) provide antimicrobial properties.^{5,7,8,9,10}

Silver dressings

There has recently been a renewed interest in the use of silver for treating local infection. It does not promote bacterial resistance and it is effective in treating resistant bacterial species. The antimicrobial efficacy of silver dressings depends on the silver content, the dressing formulation, and the way the dressing is made. A 1% silver sulphadiazine cream has historically been used for burn wounds, and there are now silver dressings emerging on the market that are less toxic than silver sulphadiazine.⁸

Several dressings on the market are impregnated with sustained-release ionic silver, most of which absorb fluid from the wound bed and have antimicrobial protection. The following is a list of some of the available silver dressings:

- Aquacel Ag (ConvaTec)
- Acticoat (Smith & Nephew)
- Silverlon (Argentum Medical)
- Arglaes (Tyco Healthcare Group LP)
- Calgitrol Ag (Magnus Bio-Medical Technologies)
- Island Wound Dressing with Microban (Medwrap Corp.)
- Silveron (Silveron Cons. Products)
- SilvaSorbantimicrobial absorbent dressing and SilvaSorb Cavity anti-microbial absorbent dressing (Medline Industries)
- Contreet (Coloplast)
- Actisorb (J&J)

These dressings are manufactured in a variety of constructions from non-adherent pads to sheets with an alginate matrix.

Slow-release iodine

Iodosorb gel and Iodoflex pads (Healthpoint) absorb exudate from the wound while reducing bacterial load with a time-released antimicrobial (cadexomer iodine).

Other dressings

Kerlix® A.M.D. (Tyco Healthcare Group LP) bandage rolls and Super Sponges are impregnated with polyhexamethylene biguanide (PHMB), an effective agent for a broad spectrum of bacteria and fungi, including MRSA and VRE. They reduce bacterial penetration through the dressing and resist bacterial colonization. Unlike silver dressings, Kerlix A.M.D. bandage, rolls and sponges do not involve a change in clinical protocol — it appears and functions like standard gauze with the addition of PHMB (Figure 1).

Costs associated with dressings

It is imperative to differentiate between the price of a dressing and the cost of care. Antimicrobial dressings are appropriate for preventive use in more compromised patients and for treatment of specific infections as indicated by the manufacturers. Because the individual costs of antimicrobial dressings vary widely — Kerlix A.M.D. bandage, rolls and sponges are the least expensive option, while silver dressings are more costly — the cost must be considered in relation to the infection in selected cases. However, antimicrobial dressings for SSIs may actually be less expensive to use because they promote more rapid healing with fewer complications and reduce downstream costs such as antibiotic treatment or extended hospitalization.

Patient education

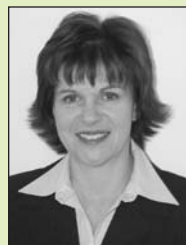
Many patients are discharged from the hospital before their surgical incisions are healed. Further surveillance is needed to identify risk factors for SSIs once patients are discharged.¹¹ As more patients undergo surgery in outpatient and short-stay settings, more SSIs will occur after discharge. To maintain the integrity of the healing incision, patients and caregivers must be educated as to how to care for the incision at home, the signs and symptoms of infection, and whom to contact if there are problems.

Conclusion

SSIs are a substantial cause of morbidity and mortality among hospitalized patients. They are the third most commonly reported nosocomial infection and account for 14% to 16% of all nosocomial infections.¹ Costs to treat them continue to escalate. Despite advances in infection control practices, there is a continued need to educate health-care providers and caregivers about appropriate techniques to prevent infection and appropriate modalities to treat SSIs.

References

1. Mangram A, et al. Guideline for prevention of surgical site infection. *AJIC* 1999;27(2):97–132.
2. Martone WJ, et al. Incidence and nature of endemic and epidemic nosocomial infections. In *Hospital Infections* (3rd ed.); Bennett JV, Brachman PS, eds. Little, Brown and Co.; Boston; 1992:577–596.
3. Kirkland KB, et al. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Con Hosp Epidemiol* 1999;20:725–730.
4. Horan TC, et al. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. *Infect Con Hosp Epidemiol* 1992;13(10):606–608.
5. Bates-Jensen BM. Management of exudates and infection. In *Wound Care: A Collaborative Practice Manual for Physical Therapists and Nurses* (2nd ed); Sussman C, Bates-Jensen BM, eds. Aspen Publishers, Inc.; Gaithersburg, MD; 2001:216–234.
6. Treatment of Pressure Ulcers Guideline Panel. *Treatment of Pressure Ulcers*. Clinical Practice Guidelines, No. 15. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research; 1994. AHCPR publication no. 95-0652.
7. Antimicrobial effects of AQUACEL® Ag on wound pathogens including antibiotic resistant bacteria. Report No. WHR12362 MA068. October 4, 2001: 1–12. Data on File, ConvaTec.
8. Antimicrobial efficacy of AQUACEL® Ag and other silver-containing dressings. Report No. WHR12379 MA072. December 21, 2001:1–9. Data on File, ConvaTec.
9. Thomas Hess, C. *Clinical Guide to Wound Care* (4th ed.). Springhouse, Pennsylvania; 2002.
10. Motta G. *Kestrel Wound Product Sourcebook* (vol 5). Kestrel Health Information, Inc., Canada; 2002.
11. McGuckin M, et al. The clinical relevance of microbiology in acute and chronic wounds. *Advances in Skin and Wound Care* 2003;16(1):12–23.



Nancy Tomaselli, RN, MSN, CS, CRNP, CWOCN, CLNC, is President and CEO of Premier Health Solutions, Cherry Hill, NJ. A certified legal nurse consultant and family nurse practitioner, Nancy specializes in wound ostomy and continence care as well as clinical, educational, and legal review and research. She is a clinical preceptor at the Harrisburg Area Enterostomal Therapy Nursing Education Program, Harrisburg, PA, and La Salle University Wound, Ostomy, and Continence Nursing Education Program, Philadelphia, PA. Nancy has served on the Wound, Ostomy, and Continence Nurses Society Task Force for the development of Home Health OASIS guidelines for wound care.

Managing Tubes and Drains: Considerations for Infection Control — Continued from page 3

S. aureus, *P. aeruginosa*, *Enterobacter*, and *klebsiella pneumoniae*. In surgical site infections, the most common pathogens are *S. aureus* and coagulase-negative staphylococcus.

Urinary tract infections

Urinary catheterization or implantation of other urological devices in the genitourinary tract is associated with nosocomial UTI. Many preventive strategies in the Centers for Disease Control (CDC) guideline for catheter-associated UTIs are applicable to patients with a nephrostomy tube. These tubes should be inserted under aseptic technique. Hands should be washed before and after tube manipulation. A closed system should be maintained as much as possible by using the aseptic technique whenever disconnecting and reconnecting a tube. Maintaining adequate hydration and the collecting system, so that it can drain by gravity, are key interventions.

Surgical site infections

Purulent drainage from a wound drain is a criterion for organ or space SSI. Infection around a stab wound for a drain is considered a skin or soft tissue infection, depending on depth.⁴ There is conflicting information in the literature about whether the presence of a wound drain increases the risk of infection. The use of a closed drainage system, e.g., a Jackson-Pratt or Hemovac drain, has become a common practice to prevent SSI.

Infection control

The landmark Study of the Efficacy of Nosocomial Infection Control (SENIC) found that hospitals with strong surveillance and prevention programs had the lowest nosocomial infection rates.¹ A comprehensive infection control plan includes surveillance of high-risk groups and benchmarking data. Institutional policies and procedures for wound care and drain or tube management require the input of infection-control practitioners. Feedback should be obtained before the hospital selects products and dressings.

Standard precautions should be maintained for any patient with a tube or drain.

Precautions for contact should be initiated for anyone with a respiratory, wound, or skin infection, particularly if they are colonized or infected with a multi-drug resistant organism that has clinical or epidemiologic significance, based on current recommendations.¹⁴ Contact precautions are also necessary for patients with a major skin abscess, cellulitis, or pressure ulcer when drainage is not contained. The use of masks, eye shields, face shields, and protective apparel is indicated when engaging in activities that generate the spraying or splashing of body fluids, such as tracheostomy care and suctioning.

The ICP provides patient education to reinforce the:

- importance of good hand hygiene before and after patient care
- use of aseptic technique when caring for and dressing tubes and drains
- importance of appropriate containment and disposal of drainage
- maintenance of a closed collection system as much as possible
- implementation of appropriate precautions
- avoidance of cross contamination by using individual disposal containers for each patient's different drains
- correct procedure for disposal of drains, such as chest-tube receptacles, active drains, and sump drains

Conclusion

Tubes and drains are continually used in patient care. They account for a significant percentage of nosocomial infections, and the rate of infection is expected to rise. The cost of tube- and drain-related infections is significant. Prevention of infection, frequent assessment, meticulous care, and appropriate use of antimicrobial dressings are key to promoting a positive outcome for patients. A comprehensive infection control program — policies, procedures, and patient education — will help to avoid complications and reduce overall healthcare costs.

References

1. Centers for Disease Control and Prevention. Feeding Back Surveillance Data to Prevent Hospital-Acquired Infections. 2001.
2. Steed C. Common infections acquired in the hospital. *Nursing Clinics of North America* 1999;34(2):443-461.
3. Memon MA, Memon B, Memon MI, Donohue JH. The uses and abuses of drains in abdominal surgery. *Hospital Medicine* May 2002;63(5):282-288.

4. *Guideline for Prevention of Surgical Site Infection*, 1999. Centers for Disease Control and Prevention 1999;20(4):247-267.
5. Dougherty SH, Simmons RL. The biology and practice of surgical drains. Part I. *Current Problems in Surgery* 1992;29:559-623.
6. Standards of Practice Committee, Society of Cardiovascular & Interventional Radiology. Quality Improvement Guidelines for Adult Percutaneous Abscess and Fluid Drainage. January/February 1995. www.sirweb.org/clinical/clinicalT25.shtml
7. Harkin H, Russell C. Tracheostomy patient care. *Nursing Times* 2002;97(25):34-36.
8. Black J, Hawks JH, Keene A. *Medical-Surgical Nursing Clinical Management for Positive Outcomes*. Philadelphia; WB Saunders Co., 2001.
9. Bartololei SA, Refsnyder C. *Patient Care in Interventional Radiology*. Gaithersburg, MD; Aspen Publisher, 1997
10. Cofield V. Percutaneous nephrostomy tubes: nursing care. *Urologic Nursing* 1995;15(4):128-130.
11. Palmieri P. Obstructive nephropathy: pathophysiology, diagnosis, and collaborative management. *Nephrology Nursing Journal* 2002;29(1):15-23.
12. Mayhew P, Guidos B. Development and evaluation of a protocol for percutaneous nephrostomy tubes. *J Enterostomal Therapy* 1988;5(5):183-186.
13. Society of Cardiovascular & Interventional Radiology. *Biliary Catheter Care*. Fairfax, VA, 1992.
14. Centers for Disease Control and Prevention. Synopsis of types of precautions & patients requiring the precautions.



Judith N. Scardillo, MS, RN, CWOCA, is a Clinical Nurse Specialist in Enterostomal Therapy at Albany Medical Center, Albany, NY. She teaches wound, ostomy, and continence nursing, co-chairs the Advanced Practice Nurse Group, and is a member of Albany Medical Center's Education Council. She is a Trustee of the Capital District affiliate of the Wound, Ostomy, and Continence Nurses Society. In 2003, Nancy received the Albany Ambassador award.

The *Infection Control Resource* is a quarterly newsletter distributed free of charge to health professionals. The *Infection Control Resource* is published by Saxe Healthcare Communications and is funded through an education grant from Kendall, a business unit of Tyco Healthcare Group LP. Our objective is to explore practical, clinically relevant topics in the field of infection control that will be of value to both the infection-control practitioner and the professional nurse. Opinions expressed in *Resource* are those of the authors and not necessarily of the editorial staff of Saxe Healthcare Communications or Kendall/Tyco Healthcare Group LP. The publisher and Kendall/Tyco Healthcare Group LP disclaim any responsibility or liability for such material. We welcome opinions and subscription requests from our readers.

Please direct your correspondence to:

Saxe Healthcare Communications
P.O. Box 1282
Burlington, VT 05402
info@saxehc.com
Fax: 802.872.7558

© Saxe Communications 2002

This continuing education activity has been awarded 1.0 contact hours by the Vermont State Nurses Association (VSNA) which is accredited as a provider and an approver of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation (ANCC-COA).

Upon completion of this program the participant will be able to:

1. describe commonly used drainage tubes.
2. relate management strategies for commonly used tubes/drains
3. discuss measures to prevent infection in the person with an indwelling tube or drains
4. identify risk factors for the development of surgical-site infections
5. discuss prevention strategies for surgical-site infections
6. describe antimicrobial dressings used to treat surgical-site infections

1. Read both articles.
2. Complete the post-test. (You may make copies of the answer form.)
3. Complete the participant evaluation.
4. Mail or fax the complete answer and evaluation forms to address below.
5. To earn 1.0 contact hours of continuing education, you must achieve a score of 70% or more. If you do not pass the test you may take it one more time.
6. Your results will be sent within four weeks after form is received.
7. **The fee has been waived through an educational grant from Kendall, a business unit of Tyco Healthcare.**
8. Answer forms must be postmarked by May 15, 2005.
9. Mark your answers clearly with an "X" in the box next to the correct answer. **Please print clearly. Illegible writing will delay processing.**

Name & Credentials _____
Position/Title _____
Institution _____
Address _____
City _____ State _____ Zip _____
Phone _____
Fax _____
License# _____
REQUIRED FOR CE CREDIT

Mail to:

Saxe Healthcare Communications
PO Box 1282, Burlington, VT 05402
Fax: 802.872.7558

1. **SSIs are defined as:**
 - a. incisional
 - b. deep SSI
 - c. organ/space infection
 - d. all of the above
2. **Risk factors associated with SSIs include all except:**
 - a. elderly
 - b. immunocompromised
 - c. diabetics with normal glucose levels
 - d. malnourished
3. **Variables used in the equation for risk of infection include:**
 - a. bacterial dose
 - b. virulence
 - c. host resistance
 - d. all of the above
4. **Preoperative prevention strategies include all of the following except:**
 - a. administer antibiotics only when indicated
 - b. routinely use vancomycin for antimicrobial prophylaxis
 - c. administer the initial dose intravenously
 - d. maintain therapeutic levels during the operation
5. **Postoperative prevention strategies include all of the following except:**
 - a. use sterile technique and supplies
 - b. irrigate with an antiseptic solution rather than saline
 - c. use dressings that provide a physical barrier to bacteria
 - d. cleanse with nontoxic solutions with adequate force
6. **Clinical infection is indicated by:**
 - a. 10^3 bacteria per gram of tissue
 - b. 10^4 bacteria per gram of tissue
 - c. 10^5 bacteria per gram of tissue
 - d. 10^6 bacteria per gram of tissue
7. **Two key approaches used to reduce the microbial load in wounds are:**
 - a. topical antibiotics
 - b. topical antiseptics
 - c. a and b
 - d. a only
8. **Antimicrobials often used for wound care include:**
 - a. silver dressings
 - b. slow-release iodine
 - c. PHMB
 - d. all of the above
9. **Mr. Smith is 2 days post-op from a total prostatectomy. He asks the nurse why the bulb on his Jackson-Pratt drain is collapsed. The best response by the nurse is to:**
 - a. connect the drain to low wall suction
 - b. instruct the patient that the negative pressure of the system is working
 - c. empty the drain and record the output
 - d. tell the patient that the drain should be removed
10. **Ms. Smith is having copious amounts of serous drainage from a sump drain. The best action by the nurse is to:**
 - a. irrigate the drain
 - b. apply an ostomy pouch
 - c. use extra gauze dressings
 - d. notify the physician
11. **Jane has a nephrostomy tube. What remark indicates she understands what she has been taught about infection control?**
 - a. I need to follow up with my physician for regular tube changes.
 - b. I don't have to worry about bladder infections.
 - c. I am glad I can take a tub bath.
 - d. I am not going to flush the tube.
12. **What drain would the surgeon most likely use when irrigation solution needs to be infused?**
 - a. Penrose drain
 - b. Jackson Pratt drain
 - c. sump drain
 - d. Levin tube
13. **Mary had an abdominal abscess drained with a percutaneous drainage catheter. The tube is draining well, but Mary has denuded skin around the drain that developed from intermittent leakage of small amounts of drainage. The best action is to**
 - a. apply an antibiotic ointment
 - b. cleanse the skin with Betadine
 - c. reposition the drain
 - d. apply a skin barrier to the area
14. **The infection control practitioner is presenting an inservice for nurses on prevention of nosocomial infections. The most important point to teach is:**
 - a. use of topical antibiotics
 - b. good hand hygiene between patients
 - c. frequent emptying of drains
 - d. the facility's dressing change policy
15. **A Penrose drain would be selected for wound management when:**
 - a. a closed system is needed
 - b. drainage is viscous
 - c. there is risk of infection
 - d. none of these

Mark your answers with an X in the box next to the correct answer

1	A B C D	4	A B C D	7	A B C D	10	A B C D	13	A B C D
2	A B C D	5	A B C D	8	A B C D	11	A B C D	14	A B C D
3	A B C D	6	A B C D	9	A B C D	12	A B C D	15	A B C D

DO NOT WRITE IN THIS SPACE

Resource Volume 2, No. _____

Score

Participant's Evaluation

1. What is the highest degree you have earned (circle one)? 1. Diploma 2. Associate 3. Bachelor's 4. Master's 5. Doctorate

2. Indicate to what degree you met the objectives of this program: Using 1= strongly agree to 6 = strongly disagree rating scale. Please circle the number that best reflects the extent of your agreement to each statement:

	Strongly Agree	4	Strongly Disagree
1. Describe commonly used drainage tubes.	1 2 3 4 5 6		
2. Relate management strategies for commonly used tubes/drains.	1 2 3 4 5 6		
3. Discuss measures to prevent infection in the person with an indwelling tube or drains.	1 2 3 4 5 6		
4. Identify risk factors for the development of surgical-site infections.	1 2 3 4 5 6		
5. Discuss prevention strategies for surgical-site infections.	1 2 3 4 5 6		
6. Describe antimicrobial dressings used to treat surgical-site infections.	1 2 3 4 5 6		

3. How long did it take you to complete this home-study program? _____

4. Have you used home study in the past? Yes No _____

5. How many home-study courses do you typically use per year? _____

6. What other areas would you like to cover through home study? _____

Mail to: Saxe Healthcare Communications, P.O. Box 1282, Burlington, VT 05402 Fax: (802) 872-7558