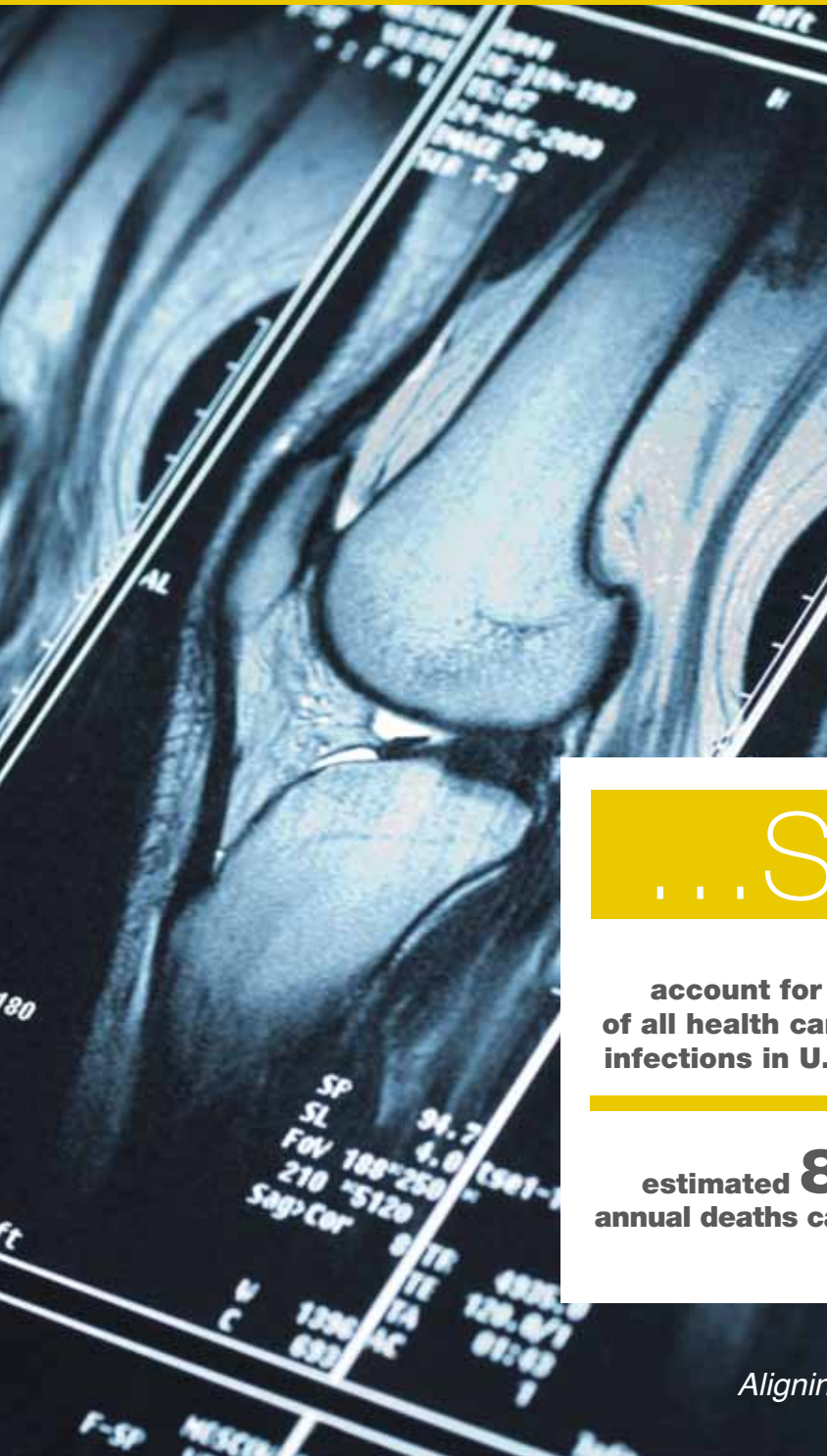


Surgical Site Infections (SSI) Following Orthopedic Surgery

by Kimberly Haines, RN, CNOR



Taking a look back in time, before the mid-1800s, “surgical patients commonly developed postoperative ‘irritative fever,’ followed by purulent drainage from their incisions, overwhelming sepsis, and often death. It was not until the late 1860s, after Joseph Lister introduced the principles of antisepsis, that postoperative infectious morbidity decreased substantially.”¹

Fast forward more than 150 years to 2012. We are doing surgery in modern ORs with high-tech equipment and advanced techniques, and yet...

...SSIs

780,000
SSIs occur each year³

account for **20%**
of all health care-associated
infections in U.S. hospitals.²

35,000
SSIs develop annually
after orthopedic surgery⁴

estimated **8,205**
annual deaths caused by SSIs²

up to **20,000**
knee and hip replacement
patients contract an SSI⁴

Astronomical costs of added care

In addition to the burden of coping with the painful and disabling effects of an SSI, patients and providers face increased healthcare costs. According to the Institute of Medicine, hospital-acquired infections cost up to \$5.7 billion per year.⁵

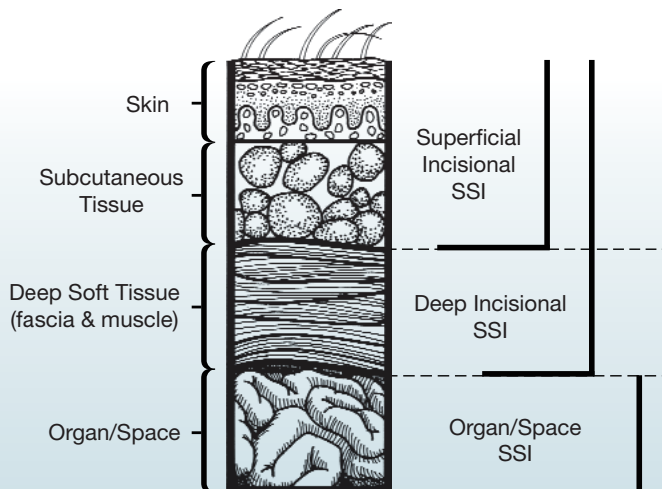
SSIs prolong a patient's total hospital stay by an average of two weeks, double the chances of being re-hospitalized and increase the total cost of health care by more than 300 percent.⁶

Clearly, there is a great need for all members of the healthcare team, including OR nurses, to help reduce the risks of SSIs.

Types of surgical site infections and how they relate to orthopedic surgery

Two types of SSIs typically occur: incisional and organ/space. Incisional SSIs are subcategorized as superficial (for example, skin, subcutaneous tissue) or deep (for example, deep soft tissues). Organ-space SSIs manifest in any body part other than the site of the incision.³

According to an orthopedic surgery-specific executive summary of the Association for Professionals in Infection Control and Epidemiology (APIC) elimination guide,⁴ orthopedic surgery frequently involves “the placement of a foreign body, such as a prosthetic joint, various joint components, or hardware used to stabilize bony structures or repair fractures.” Unfortunately, placing these structures increases the risk of infection, either by introducing local contamination or by spreading microorganisms through the bloodstream.⁴ The APIC executive summary also states that “locally introduced contamination can occur during the perioperative period. Spread of microorganisms occurs after the perioperative period and is associated with primary bacteremia or infection at a site distant from the surgery. Secondary bacteremia from this distant infection leads to microbial seeding of the prosthetic joint.”⁴ In addition, biofilm from bacterial microorganisms that may be attached to a prosthetic implant can cause an SSI to develop.⁴



Layers of skin and deep space.

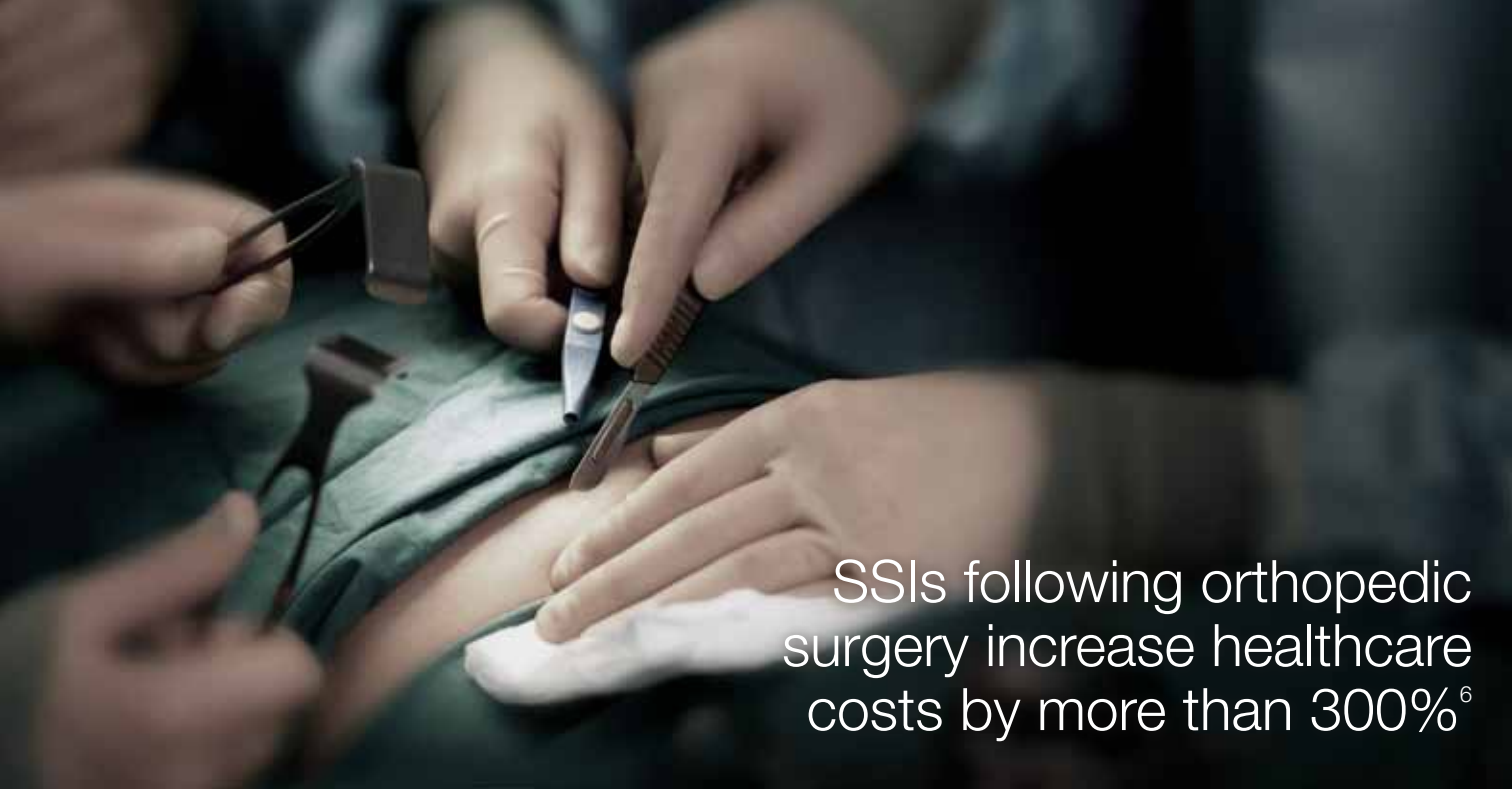
Patient Risk Factors for Developing SSI³

- Advanced age
- Poor nutritional status
- Diabetes
- Cigarette smoking
- Obesity
- Colonization with microorganisms
- Coexisting infection at a remote body site
- Altered immune response
- Preoperative hospitalization

Common risk factors associated with SSI

It is important for OR nurses to know the types of factors related to both an individual patient and the hospital environment that can increase the risk of a patient developing an SSI. The World Health Organization (WHO)³ outlined the following characteristics of patients who may have an increased risk: advanced age, poor nutritional status, diabetes, cigarette smoking, obesity, colonization with microorganisms, coexisting infection at a remote body site, altered immune response, and preoperative hospitalization.³

Also, WHO listed characteristics of the surgical procedure that can increase the likelihood of developing an SSI.³ These include inadequate preoperative skin preparation, inappropriate preoperative shaving, inadequate surgical team preoperative hand and forearm antisepsis, contaminated operating room environment, inappropriately sterilized surgical attire and drapes, inadequate sterilization of instruments, excessive duration of



SSIs following orthopedic surgery increase healthcare costs by more than 300%⁶

operation, poor surgical technique, and inappropriate or untimely antimicrobial prophylaxis.

Most hospital infection prevention teams use National Healthcare Safety Network (NHSN) definitions for postoperative surveillance of patients at risk for SSIs. Because most cases of SSIs appear after the patient has left the hospital, the NHSN protocol states that healthcare practitioners should monitor patients for SSIs for up to 30 days after the surgical procedure.⁴ OR nurses should refer to the APIC guide for examples of how to monitor patients^{4,7} and for descriptions of a variety of factors that may be associated with increased rates of SSI following orthopedic surgery.⁷

Preventing SSIs in orthopedic surgery patients

Eliminating modifiable risk factors can help prevent SSIs,⁴ and there are many proven strategies to achieve this goal. For example, OR nurses can ensure that clean and disinfected equipment are used and that the surgical environment is pristine; they can also ensure that the team

uses evidence-based practices for hand hygiene and surgical site preparation.⁴ Preoperative skin preparation for patients is important because microorganisms commonly associated with patients predominate in orthopedic SSIs.⁴ In particular, OR nurses can verify that patients have showered before having an orthopedic-related surgery to reduce bacterial colonization of the skin.⁴

For more specific interventions, OR nurses can refer to the previously mentioned APIC guidelines for eliminating SSIs. Published in 2010, these guidelines are easily accessible online at the APIC website (<http://apic.org/Professional-Practice/Scientific-guidelines>).⁴ These guidelines offer comprehensive approaches for all healthcare professionals to consider as they develop the most effective orthopedic SSI prevention program for their specific hospital or ambulatory setting.⁴

Although no standardized clinical practice guidelines exist regarding which SSI prevention strategies can reliably reduce the risk of infection after a total hip arthroplasty (THA), Merollini and colleagues⁶ identified the following infection prevention measures to be critical based on a review of expert opinion and

Perioperative Conditions Often Related to SSI³

- Inadequate preoperative skin preparation
- Inappropriate preoperative shaving
- Inadequate surgical team preoperative hand and forearm antisepsis
- Contaminated operating room environment
- Inappropriately sterilized surgical attire and drapes
- Inadequate sterilization of instruments
- Excessive duration of operation
- Poor surgical technique
- Inappropriate or untimely antimicrobial prophylaxis

Antibiotic prophylaxis

[an·ti·bi·ot·ic pro·phy·lax·is]

1 : The prevention of infection complications using antimicrobial therapy

clinical guidelines: preoperative antibiotic prophylaxis, antiseptic skin preparation of patients, hand and forearm antisepsis by surgical staff, intraoperative use of sterile gowns/surgical attire, ultraclean/laminar air operating room, antibiotic-impregnated cement, and postoperative surveillance. These investigators stressed that the degree to which these measures can be efficiently and effectively incorporated into practice depends on the cost-effectiveness and usefulness of each measure in any given healthcare setting.⁸

The experts whom Merollini and colleagues⁸ interviewed agreed primarily on the importance of the recommendation for appropriate antibiotic prophylaxis. They recognized this strategy as being highly effective in theory and in practice and as being established as a routine safety measure for patients undergoing THA.⁸ Merollini and colleagues⁸ also stressed that a comprehensive approach is necessary to successfully prevent SSIs after THA, and that nurses may need to use a combination of interventions.⁸ By identifying patients who are at high risk for developing an SSI

after having a THA or total knee arthroplasty (TKA), healthcare professionals, including OR nurses, can help improve the reporting of the incidence of SSIs and verify or set in motion appropriate prevention strategies before surgery occurs.⁹ Berbari and colleagues⁹ developed a risk assessment tool for prosthetic joint infection in use at Mayo Clinic in Rochester, Minn. Their results highlighted the usefulness of a risk assessment tool in terms of both patient care and for the prevention of costly complications that may or may not be reimbursed by insurance providers. Because more than four million THAs or TKAs are estimated to be performed by 2030, healthcare professionals should diligently assess patients' risk status and conduct preventive strategies.⁹ Minimizing a patient's risk of developing an SSI after orthopedic surgery is useful for both the patient's well-being and for the healthcare facility's bottom line.⁹

Using teamwork to address SSIs

Teamwork is essential for addressing the problem of SSIs. It is evident that fostering a culture in the healthcare facility that leans toward teamwork is important in preventing SSIs that occur following orthopedic surgery.⁴

Real Stories from People Affected by SSIs

The following real patients share how infection following orthopedic surgery has changed their lives. They went into surgery disabled by a broken bone or a failing joint, hoping to come out stronger than before. Unfortunately these patients contracted a hospital-acquired infection, which led to a lesser quality of life, often accompanied by further surgeries and years of pain and loss.

These stories and more are provided through the Safe Patient Project, a Consumers Union campaign focused on eliminating medical harm, improving FDA oversight of prescription drugs and promoting disclosure laws that give information to consumers about healthcare safety and quality. To learn more, visit <http://safepatientproject.org/>.

Alice Buehring Gold Bar, Washington

After taking a bad fall in January 1999, I required surgery to replace the humeral head in my right shoulder. Unfortunately, my recovery was painful and mostly unsuccessful. By May 1999, I discovered why. It turned out that I developed a *Pseudomonas aeruginosa* infection in the surgical site, which was fast becoming septic. I spent the next week in the hospital on IV antibiotics to treat the infection. I was discharged to continue my IV treatments at home for another six weeks followed by oral antibiotics for another six weeks.

By the end of these treatments, I hoped that the worst was behind me. But my recovery continued to be painful and difficult. For the next six years, I struggled to find relief. I began to work with some natural and alternative healthcare practitioners who believed my arm was still infected. Most of the time my arm hurt enough to require pain medication and was periodically hot. I would slowly gain range of motion in my arm, only to lose it again. Each year I would return to my surgeon when the pain became unbearable. And each time he would insist that the infection was no longer present and send me home with more pain medication.

In May 2004, my pain became impossible to endure. I returned to my doctor who took another X-ray of my arm and finally determined that the infection was still present. By then, the infection had eaten through my humerus bone and destroyed my rotator cuff. I underwent a second surgery to remove the prosthesis, spent three days in the hospital recuperating and then continued my IV antibiotic treatments at home for another six weeks. Once the infection cleared up, I had a third surgery to insert a new prosthesis and then began physical therapy. Finally, I was infection free.

My hospital infection experience has had a lasting impact. I now have only a 20 percent range of motion in my dominant arm, which has limited my abilities in my daily life and at work, and I still haven't gotten my energy back. I am grateful to be alive, that I still have an arm, and that the damage was not more extensive, but angry that an infection I caught in the hospital turned my life upside down for so long. I continue to live my life upside down.



Sandi Sampson Boaz, Alabama

When I had ankle replacement surgery in December 2003, I looked forward to finally recovering from a broken ankle bone I injured in my backyard. Unfortunately, I left the hospital not only with a new ankle, but also a staph infection from my surgery. In the weeks following the operation, I felt tired and always seemed to run a low grade fever, but I didn't think much of it. I was diagnosed with the infection after my cast was removed three months after my surgery, and it became clear during physical therapy that the ankle replacement had failed. Tests revealed that I had methicillin-resistant *Staphylococcus aureus* (MRSA), a difficult-to-treat infection.

As a result, the prosthesis was removed and an antibiotic spacer was installed in its place. I underwent 12 weeks of Vancomycin treatments administered through a PICC line at home. The infection seemed to improve, and I had another ankle replacement surgery. But the prosthesis never bonded to the bone, and I experienced another outbreak of MRSA. I was put on Vancomycin for another month to treat the infection. In June 2005, I had another surgery to install a concrete spacer in place of my ankle, but again it failed to adhere to my bone.

My doctor has told me that the MRSA, which is in my bone and blood, will never go away. It becomes dormant after it is treated, but trauma to my body – like a spider bite I got in November 2005 – can cause it to re-emerge. I underwent another surgery in May 2006 to address my ankle problem. I fought to save my life and leg for four years: 37 surgeries. Finally, the only way to save my life was to remove my leg. I had that done in February 2007.



Glenn Cartrette Castle Hayne, North Carolina

On January 1, 2003, my husband, Glenn Cartrette had knee surgery. After three weeks he went back to work and found he had a new pain in his hip joint, which grew worse during his 17-hour work days.



Glenn and Teri Cartrette

Glenn had a full hip replacement in October. After the two surgeries, pain began to be a daily part of Glenn's life. Finally the pain was so intense that he no longer could go to rehab. Then problems started with his lungs. The orthopedic surgeon said there was nothing wrong with his surgery but during one of his many hospital admissions Glenn and I were told he had MRSA. He was placed in a private room where visitors were required to wash their hands, put on a gown, gloves and mask before entering the room. He spent weeks in the hospital and continued to take Vancomycin for the MRSA after he was released.

After returning home Glenn continued to have pain and difficulty breathing, which required visits to the emergency room often. I would beg for help because I could see the stress on him just to breathe. We also consulted with pain management doctors to monitor the pain medications needed in ever-increasing doses. Except for about 15 days in a nursing home, Glenn was in the hospital from July 2005 until January 2006. His lungs were infected with MRSA, and he was in a great deal of pain. He died on January 26, 2006, unaware of what was going on around him. Death was the only escape from the horrible things MRSA had done to him and his body.

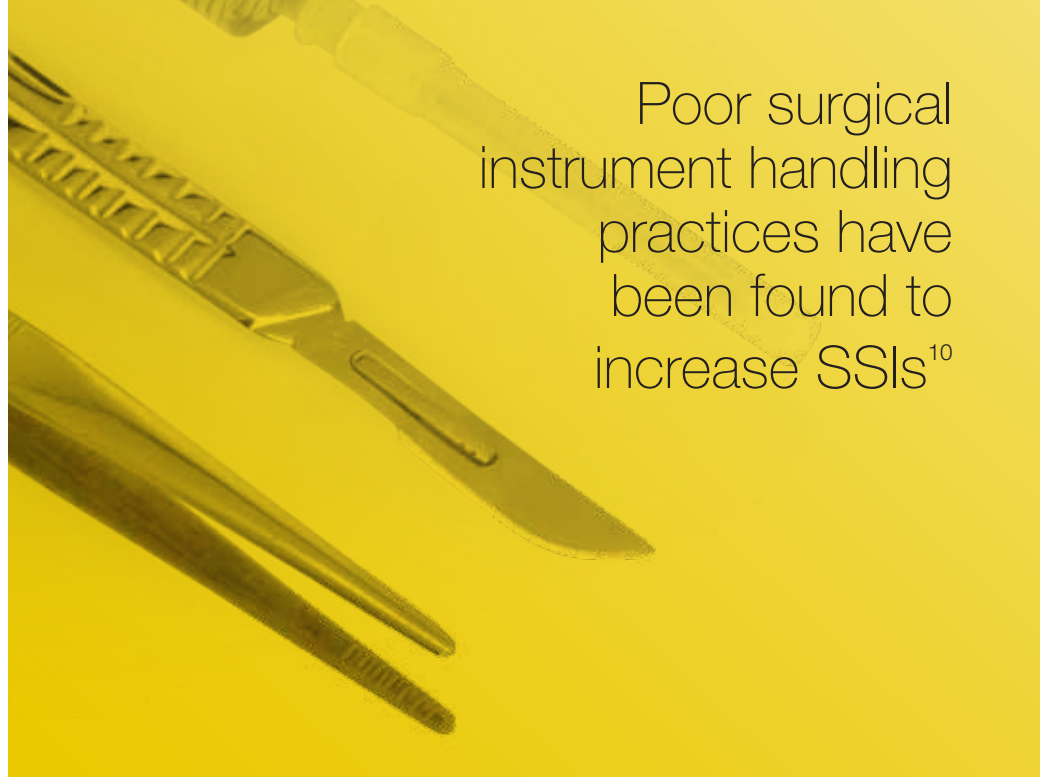
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Focusing on patient-centered care, communicating well with patients and healthcare colleagues in all positions, and having leaders who emphasize the need for all team members to understand the importance and the effects of SSIs in orthopedic surgery patients are useful strategies.⁶ Risk assessment tools and simple cleaning and presurgical checklists can be created or customized to fit each facility.⁴

Working together, one team (including infection control staff members, surgeons, nurses, and perioperative staff members) reduced the rate of SSIs in their orthopedic surgical setting by 60 percent; their results included not having a single patient develop a MRSA-related SSI over the course of one full year.⁷ Collaboration and a concerted effort to follow accepted preoperative prophylaxis protocols were critical components to their success.

Another way a team can use communication to reduce the risk of SSIs is by taking a “time-out” before making the initial surgical incision.⁶ The time-out provides needed time for team members to check whether appropriate and timely antibiotic prophylaxis procedures have been completed and to ensure that the sterilization level is optimal.⁴

Effective infection prevention and control programs can help reduce the risk of patients developing SSIs.⁷ OR nurses, along with other specialists, must understand the common characteristics of patients undergoing orthopedic surgery, be able to identify and address the risk factors, use accepted methods for case



Poor surgical instrument handling practices have been found to increase SSIs¹⁰

finding, analyze data, communicate outcomes, and implement evidence-based strategies to improve outcomes.⁷ To achieve these goals, collaboration among team members is critical.⁷

Abdul-Jabbar and colleagues¹⁰ analyzed a total of 6,628 patients who underwent spinal surgery. They found that 193 (2.9 percent) of all spinal surgery patients had an SSI, and that patients with SSIs exhibited many of the commonly known risk factors (for example, diabetes, revision surgery, extended operative time, and transfusion). Because they also noted risk factors for predicting whether a patient would develop an SSI that were unique to their own study participants (for example, diagnoses of neoplasm and coagulopathy and having had anterior or posterior surgery), they recommended that these factors be added to their facility’s preoperative risk assessment process.

Richards and colleagues¹¹ evaluated a large sample of patients who underwent orthopedic surgery. Based on their results of patients who had developed SSIs 30 days

after surgery, they determined that recognizing that a relationship exists between hyperglycemia and infectious complications could influence positively the postoperative care of orthopedic patients.

Dancer and colleagues,¹² in a study conducted in Scotland, linked a sharply increased rate of deep SSIs in orthopedic (and ophthalmic) patients with the contamination of sets containing surgical instruments that occurred after sterilization techniques had been done. They found that poor handling practices at the facilities participating in the study and at the sterilization plant were related to a sharp increase in SSIs. Their results highlighted the need for close cooperation and collaboration among sterile service providers, managers, and clinical staff members. They suggested a series of guidelines to lower the risk of sterile surgical instruments becoming contaminated before use that included using adequate cooling and drying procedures at the sterilization plant along with focusing their inspections on finding damp packs. Other key recommendations

included periodically visiting sterilization site locations; performing weekly audits of procedures and issuing reports to stay abreast of the results; regularly reviewing cleaning processes, inspection processes; and providing ongoing staff training and supervision related to these processes. As a result, infections rates among patients receiving clean surgical procedures returned to levels that were consistent with those noted before the sharp increase, which was the reason this study was conducted.

Gathering follow-up data to decrease patients' likelihood of future SSIs

Keeping track of the types and frequency of SSIs that occur in or as a result of a stay in a healthcare facility is important.¹¹ Using guidelines for procedure categories described by the Centers for Disease Control and Prevention (CDC) as well as the NHSN guidelines is essential.¹³ Correct coding and other helpful details will ensure appropriate record keeping.

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In conclusion, all members of the healthcare team, particularly OR nurses, can help reduce the incidence of SSIs in patients who have had orthopedic surgery. Among the important steps to take are identifying patients who are at risk for developing SSIs and taking extra care to address these risk factors before, during and after surgery.

Also, familiarity with the appropriate clinical guidelines that outline risk factors in patients and understanding and implementing recommended sterilization practices in the preoperative and surgical environment are extremely important. Working collaboratively with all members of the healthcare team is a critical strategy that serves patients, the team and the facility in the common goal of avoiding SSIs.

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