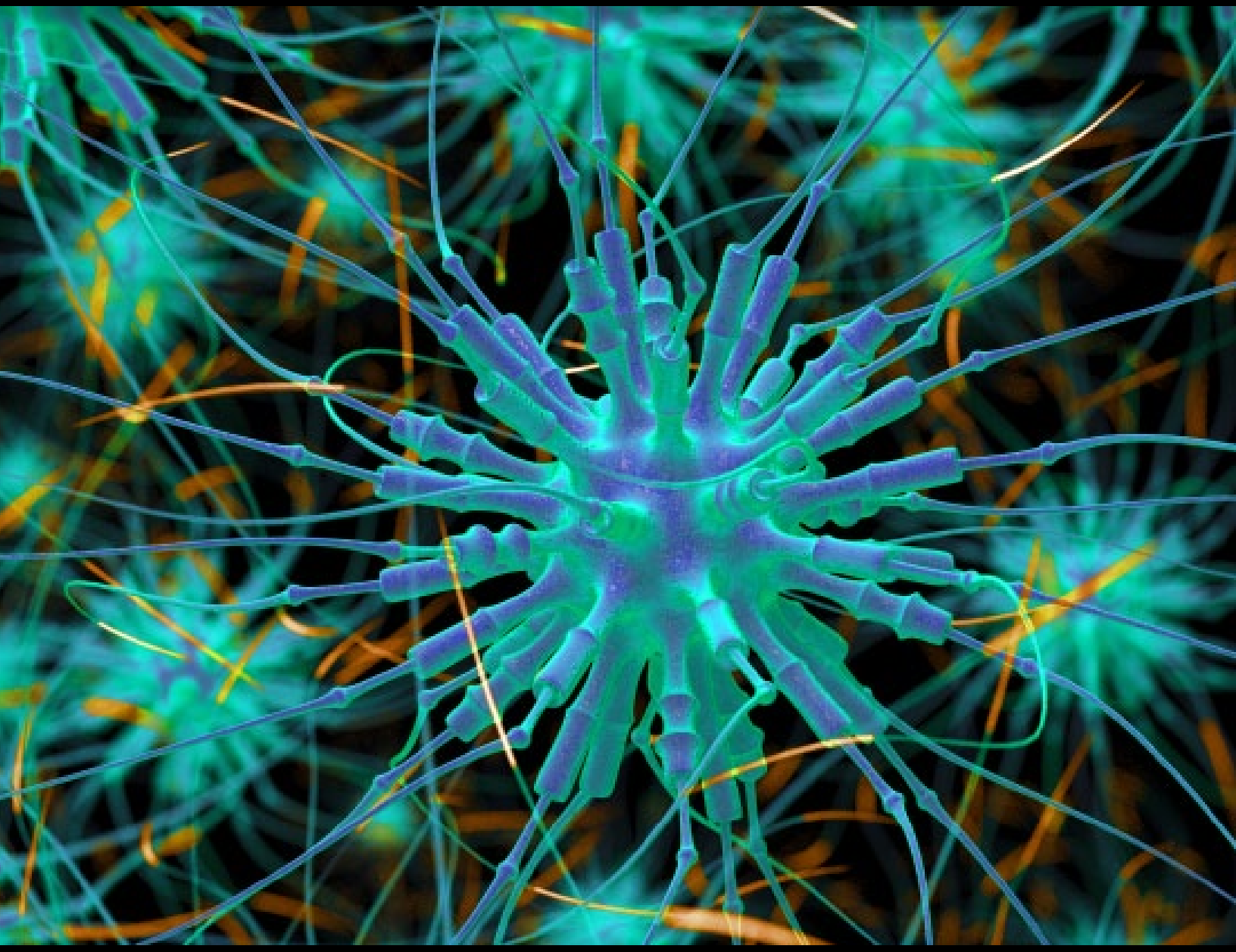
AMERICAN SENTINEL UNIVERSITY

Are you prepared to identify and prevent the three infections that make up two-thirds of all

HEALTH CARE ASSOCIATED INFECTIONS?



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INTRODUCTION

Hospitals are meant to be places of healing, yet every year an estimated 1.7 million Americans will develop a health care associated infection (HAI) while hospitalized – and 99,000 patients will die from one, according to the department of Health and Human Services. These secondary infections are not only devastating to the patient, but they also create an enormous financial burden on the health care system as a whole, with a total dollar cost between $28 and $33 billion a year.

The Centers for Disease Control and Prevention (CDC) estimates that three types of infections account for roughly two-thirds of all HAIs:

- Central line associated bloodstream infection (CLABSI)
- Catheter associated urinary tract infection (CAUTI)
- Ventilator associated pneumonia (VAP)

Nurses play a key role in minimizing the occurrence of these infections. In fact, CDC guidelines include nursing-specific interventions for the prevention of each of them. But the sad fact is that studies show clinicians don't reliably follow even the most basic recommendations – like keeping the patient's head elevated to prevent ventilator associated pneumonia.

This guide will serve as an overview of the HAI risk factors and basic prevention measures that every nurse should be aware of, with additional resources listed at the end of each section.

And if you are interested in planning, implementing and evaluating infection prevention and control measures, consider making this field your career specialty. As a first step, you can develop new skills and empower yourself with knowledge through an online RN to MSN degree with a specialization in infection control from American Sentinel University, an innovative, accredited provider of online nursing degrees.

CATHETER ASSOCIATED URINARY TRACT INFECTION (CAUTI)

As front-line caregivers, nurses can help their patients avoid a CAUTI and its potential complications. To do this, you need to know how the infection develops, which prevention strategies are recommended, and why it's critical to follow the guidelines.

OVERVIEW & INCIDENCE

For too long, CAUTIs were expected and accepted by nurses, due to a widespread belief that not much could be done to prevent them, and that colonization of the urinary tract by bacteria was inevitable in the catheterized patient. That antiquated notion is no longer accepted in health care, and hospitals everywhere are acting proactively to prevent all types of hospital-acquired infections, including CAUTIs.

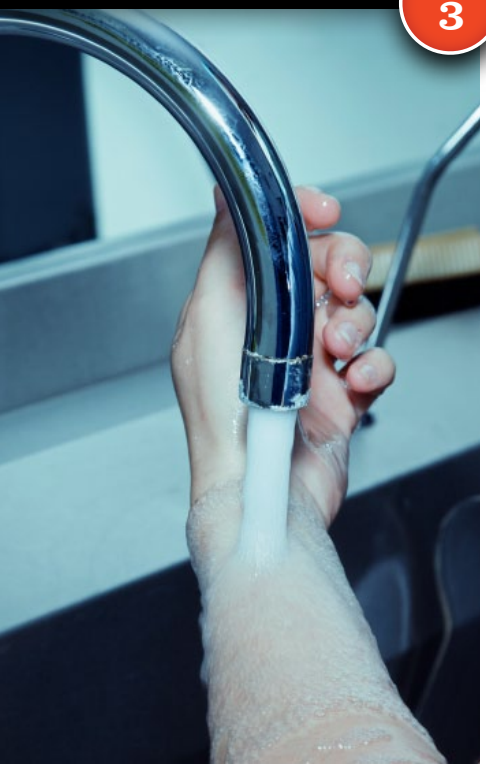
Urinary tract infections are the most common type of nosocomial infection by far, accounting for up to 40 percent of infections reported by hospitals. As many as 80 percent of these hospital-acquired UTIs are correlated with the use of an indwelling urinary catheter. Due to this high incidence, the overall costs to the health care system are staggering, with an estimated $451 million spent annually in the United States to manage these infections. In some cases, particularly in immunosuppressed patients, a CAUTI can progress to sepsis and even death.

Concerns about costs, length of stay, and patient safety would be good enough reasons to establish protocols to reduce the incidence of CAUTIs, but now there's a financial concern as well – as of Oct. 1, 2008, Medicare has deemed these events to be "preventable" and will no longer pay for the cost of care associated with them. Instead, the tab will be picked up by the hospital itself, since the rules don't allow the costs to be passed on to the patient. (Since then, several large insurers have followed suit with their own announcements that they will no longer reimburse for CAUTIs.)

RISK FACTORS

According to the CDC, between 15 and 25 percent of hospitalized patients receive urinary catheters during their hospital stay. Other surveys place this figure higher, suggesting that up to 90 percent of ICU patients end up with a catheter. And many studies have found that catheters are frequently used unnecessarily, placing patients at risk for complications.

Female patients, the elderly, and those with compromised immune systems may be at increased risk for CAUTIs. However, the duration of catheterization is the most important risk factor for infection. Limiting the use of catheters to



begin with, and then limiting the number of days the catheter remains in place are the primary strategies for minimizing risk.

PREVENTION

Nurses are responsible for managing indwelling urinary catheters, and can effectively employ these core strategies to help prevent CAUTIs. (Core strategies are defined by the CDC as those that are backed by high levels of scientific evidence and have demonstrated feasibility.)

- Many hospitals have developed written guidelines for urinary catheterization. Nursing can adapt these guidelines into a checklist of indications for indwelling catheters, and then try to ensure that only patients who meet these indications actually receive a catheter. *The goal is to minimize use in all patients.* Catheters are not indicated for the management of incontinence, except in rare circumstances. If you believe a catheter is not indicated for a particular patient, talk to a nursing supervisor or the patient's physician.
- If your hospital has devices and supplies available that allow you to use the most commonly used alternatives to indwelling catheters, make sure you are trained in their use.
- Always use aseptic technique for the placement, manipulation, and maintenance of indwelling catheters – and remember that *handwashing is the first and most important preventive measure*, followed by the use of barrier precautions such as sterile gloves, drape, sponges, antiseptic solution and single-use packets of sterile lubricant.
- Following aseptic insertion of the catheter by properly trained staff, maintain a closed drainage system and unobstructed urine flow (be sure there are no kinks in the tubing, etc.)
- In postoperative patients, remove catheters as soon as possible. The CDC recommends removal within 24 hours, unless there are appropriate indications for continued use.
- Every day, conduct a review of all patients with catheters, and advocate for the removal of those that are no longer necessary. Research shows that "forgotten catheters" are often inappropriate catheters – so don't assume that physicians are always aware of a patient's catheter status; it's your job to speak up.
- If your hospital has implemented protocols for nurse-directed removal of unnecessary catheters, become familiar with them and follow them – these allow for nursing assessment and intervention without a physician's order. Some hospitals are instead using prewritten stop orders to ensure that post-op catheters are removed within a specified time period, or are implementing a system of alerts or reminders to remove catheters that are no longer necessary.

- Participate fully in all process improvement measures, like those designed to measure compliance with indications for catheter placement. The CDC recommends the use of metrics, like number of CAUTIs per 1000 catheter-days, to keep track of improvements in CAUTI rates.

RESOURCES

- The CDC's latest recommendations are compiled in the *2009 Guideline for Prevention of CAUTIs* (PDF).
- The CDC also offers a CAUTI Toolkit that can be downloaded as either a PowerPoint presentation or a PDF file (click the link for the format you want).
- Another very useful, outline-styled summary of evidence-based prevention techniques is found in *Strategies to Prevent Catheter-Associated Urinary Tract Infections in Acute Care Hospitals*, a joint publication from the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA).
- Recommendations from the Association for Professionals in. Infection Control and Epidemiology (APIC) can be found in the Guide to the Elimination of Catheter-Associated Urinary Tract Infections (PDF).
- A PowerPoint presentation from the University of Colorado explains protocols for *Nurse-Driven Urinary Catheter Removal* (PPT).

VENTILATOR ASSOCIATED PNEUMONIA (VAP)

As front-line caregivers, ICU nurses can help their ventilated patients avoid VAP. To do this, you need to know how it develops, which prevention strategies are recommended, and why it is critical to follow the guidelines.

OVERVIEW & INCIDENCE

Mechanical ventilation is a core component of supportive therapy for critical care patients who cannot breathe adequately on their own. Yet while a ventilator is often a lifesaving measure, it can frequently cause complications, including the nosocomial infection known as ventilator associated pneumonia, or VAP – defined as an airway infection that develops more than 48 hours after the patient was intubated (which indicates that it wasn't present or developing at the time of intubation).

VAP is one of the most commonly acquired infections in the ICU, second only to catheter associated urinary tract infections (CAUTIs). However, statistics regarding its incidence are inconsistent and may depend on the patient population being studied. One review of the literature concluded that:

> *In early studies, it was reported that 10%–20% of patients undergoing ventilation developed VAP. More-recent publications report rates of VAP that range from 1 to 4 cases per 1,000 ventilator-days, but rates may exceed 10 cases per 1,000 ventilator-days in some neonatal and surgical patient populations.*

VAP is the most fatal of the hospital acquired infections, with higher mortality rates than either central line infections or sepsis. Ventilated patients who develop VAP have mortality rates of 45 percent, compared to 28 percent for ventilated patients who do not develop VAP.

In addition, VAP prolongs the time the patient spends on the ventilator, in the ICU and in the hospital. Strikingly, VAP adds an estimated $40,000 to the hospital bill – putting this complication under the scrutiny of the Centers for Medicare and Medicaid Services (CMS), although the government agency has not yet declined to reimburse for VAP, because it is not entirely clear that it can always be prevented.

RISK FACTORS

VAP occurs when there is a bacterial invasion of the pulmonary system in a patient receiving mechanical ventilation. The primary risk factor is the endotracheal tube itself – it can provide a direct passageway for airborne pathogens into the lungs, or act as a reservoir for pathogens by providing a place for biofilm to form or secretions to pool. The endotracheal tube also

cancels out many of the body's protective mechanisms – for example, it prevents the patient from coughing, which is a natural defense for clearing secretions that may otherwise be aspirated.

Patients who are elderly or immune compromised are at increased risk of VAP, as are those with an existing pulmonary illness (COPD, asthma, emphysema). Other risk factors include prolonged duration of ventilation, feeding by nasogastric tube, maintaining patients in a supine position, and staff non-compliance with handwashing and other infection control protocols.

PREVENTION

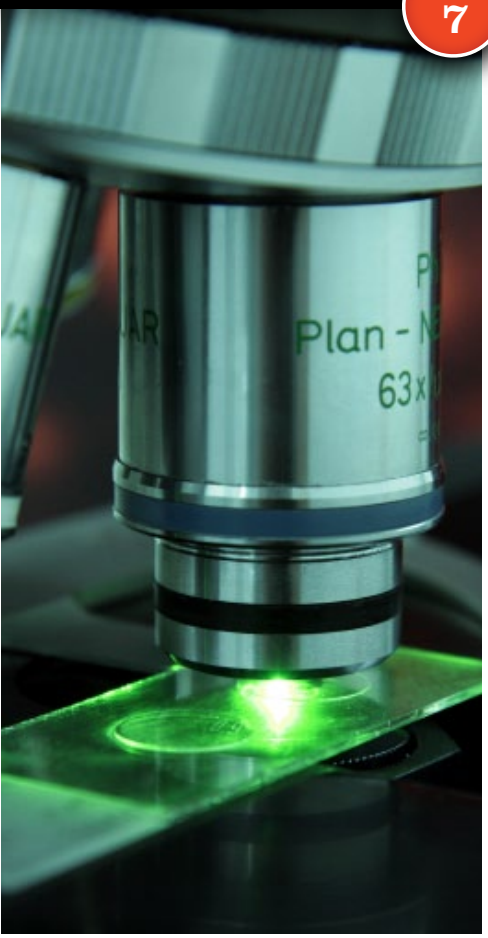
Core strategies for preventing VAP focus on interrupting the three most common mechanisms by which it develops: the aspiration of secretions, the colonization of the aerodigestive tract, and the use of contaminated equipment. (Core strategies are defined by the CDC as those that are backed by high levels of scientific evidence and have demonstrated feasibility.)

The CDC recommends using non-invasive, positive-pressure ventilation (delivered continuously via a face or nose mask) instead of intubation wherever possible and minimizing the duration of ventilation. Proactive surveillance of ventilated patients is needed, particularly by nursing and respiratory therapy staff.

Three of the core recommendations for VAP prevention are *autonomous nursing interventions* that nurses practice every day in the ICU. They are as follows:

- Practicing good hand hygiene is essential – clean your hands with soap and water or an alcohol-based rub before touching the patient or the ventilator.
- Maintaining the patient's oral hygiene can help to prevent bacterial colonization of the endotracheal tube. Regular care with an antiseptic solution is recommended, although specific practices are not currently defined – so you may need to periodically consult the current literature for specific recommendations about products that are most useful.
- Unless there are contraindications, maintain the patient in a semirecumbent position, with the head of the bed elevated at an angle of 30 to 45 degrees, to help prevent aspiration. An analysis of risk factors associated with VAP found up to a 67 percent reduction in its incidence in patients maintained this way during the first 24 hours of intubation. Another randomized study of 86 ventilated patients found that those maintained in the semirecumbent position had a VAP incidence of only 5 percent, compared to 23 percent for the supine patients. And many other observational or randomized studies have confirmed the impact of patient position – while indicating that the preferred, semirecumbent position is rarely maintained.

Other VAP prevention strategies are not autonomous nursing actions, but rather reflect measures taken by the interdisciplinary care team (although



these are sometimes implemented and monitored by the nursing staff). They include the following:

- A key concern is that secretions accumulate above the cuff on the endotracheal tube – and since the tube prevents the glottis from closing, these secretions can be aspirated or can leak into the lungs. Suctioning them is difficult because they can't be reached by typical oral suctioning methods, so the CDC recommends using a device known as a CASS tube which provides constant suction of oral secretions. Research indicates the device greatly lowers the chance of VAP.
- CDC guidelines also recommend using orotracheal rather than nasotracheal intubation, unless contraindicated. Nasal tubes can cause sinus infections, which can result in pathogens reaching the lower respiratory tract.
- Some studies suggest that proton pump inhibitors (Prevacid, Prilosec), which are commonly prescribed to prevent stress ulcers and gastritis in ICU patients, may increase the risk of VAP, by changing the acidity of the aerodigestive tract and making it more susceptible to bacterial colonization. Joint recommendations issued by SHEA and IDSA suggest avoiding PPIs whenever possible, but indicate that the preferential use of sucralfate (brand name Carafate) instead of PPIs is considered by the CDC to be an unresolved issue.
- The joint SHEA/IDSA guidelines also recommend a protocol to lighten sedation at regular intervals, in order to assess for neurological readiness to wean the patient from ventilation. (For ICU nurses, this will require increased monitoring and vigilance, as lightly sedated patients may be at increased risk of pain, anxiety or attempts to self-extubate.) A randomized trial of 128 ventilated patients demonstrated that daily interruption of sedation resulted in a significant reduction of time on ventilation – decreasing the duration from 7.3 days to 4.9 days.
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RESOURCES

- The CDC's latest recommendations can be found in *Guidelines for Preventing Health-Care--Associated Pneumonia*, last updated in 2003.
- Another very useful, outline-styled summary of evidence-based prevention techniques is found in *Strategies to Prevent Ventilator-Associated Pneumonia in Acute Care Hospitals*, a joint publication from the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA).
- Recommendations from the Association for Professionals in. Infection Control and Epidemiology (APIC) can be found in the *Guide to the Elimination of Ventilator-Associated Pneumonia* (PDF).

CENTRAL LINE ASSOCIATED BLOODSTREAM INFECTION (CLABSI)

As front-line caregivers, nurses can help their patients avoid a bloodstream infection resulting from a central line, also known as a central venous catheter. To do this, you need to know how the infection develops, which prevention strategies are recommended, and why it is critical to follow the guidelines.

OVERVIEW & INCIDENCE

Central lines are used in critical care units, neonatal intensive care units, oncology centers, and general inpatient settings to deliver medication or fluids. The CDC has defined the term "central line" as a catheter whose tip terminates in a great vessel (these include the aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins and femoral veins). To further clarify this definition, the CDC states that neither the type of line nor the insertion site alone are determining factors as to whether a catheter is a central line – if it terminates in a great vessel, then it is a central line! (Note that this also includes peripherally inserted central catheters, or PICC lines.)

A bloodstream infection is considered to be associated with a central line if the line was in use during the 48-hour period before the infection developed. These central line associated bloodstream infections must be laboratory confirmed, or the patient must meet the clinical criteria for a diagnosis of sepsis.

CLABSI increases time spent in the ICU and prolongs total hospitalization time by a mean of seven days, according to the Institute for Healthcare Improvement (IHI). A joint report by SHEA and IDSA states that the attributable cost of CLABSI varies from $3,700 to $29,000 per episode.

CLABSI is among the most serious of the hospital-acquired infections, proving fatal for between 12 and 25 percent of the patients affected, according to the CDC. The CDC estimates that 41,000 CLABSIs occurred among hospitalized patients in 2009, with about 18,000 of these occurring in the ICU setting. Hospitals are making progress however, as CDC data shows that 58 percent fewer bloodstream infections occurred in ICU patients with central lines in 2009 than in 2001.

CLABSIs are on the list of preventable hospital-acquired infections that Medicare will no longer pay for, as of Oct. 1, 2008. Instead, the tab will be picked up by the hospital itself, since the rules do not allow the costs to be passed on to the patient. CLABSI rates are often tracked and reported as a quality assurance measure, and some state health departments require CLABSI reporting.

RISK FACTORS

Approximately 48 percent of ICU patients have a central line, according to a widely cited statistic. The risk of infection in the ICU is often higher than in general inpatient settings – reasons for this include frequent insertion of multiple lines, certain types of arterial catheters that are almost exclusively used in ICU patients and are associated with substantial risk, the fact that the lines are often placed in emergency situations, and the likelihood that lines will be repeatedly accessed and left in place for extended periods.

Inserting the central line through the femoral vein has been correlated with a greater risk of infection in adults, although not in children. Also, several non-randomized studies show that using the subclavian vein for central line insertion carries a lower risk of CLABSI than using the internal jugular vein (determining the optimal insertion site for a patient must be considered on an individual basis).

Less than ideal care of the central line is a significant risk factor for infection. This can include anything from excessive manipulation of the catheter to low nurse-to-patient ratios and inadequate staff training.

PREVENTION

Education and training are key strategies in preventing CLABSI – only highly competent staff should insert central lines. In many hospitals, infection preventionists are accountable for weighing all current research and guidelines and designing protocols for nurses and physicians to follow. A central line insertion checklist is a useful tool for nursing staff.

All nurses should be aware of the "central line bundle." The term refers to a group of five evidence-based strategies (described below) for the insertion and management of central lines. *When implemented together, the bundled strategies result in better outcomes than when each strategy is implemented individually*. In addition, the bundle approach promotes collaboration among members of a multi-disciplinary care team.

The central line bundle has proved effective in the following case studies, described in a paper issued by the IHI:

- A statewide initiative in Michigan over an 18-month period resulted in a 66 percent reduction in CLABSIs.
- In Rhode Island, a 30-month ICU Collaborative demonstrated that implementing bundles of best practices for CLABSI prevention reduced the CLABSI rate by 74 percent statewide.
- A similar statewide ICU Collaborative in Hawaii reduced the mean CLABSI rate from 1.5 infections per 1000 catheter-days to just 0.6 infections per 1000 catheter-days 18 months after the initiative was started.

The central line bundle has five key components:

- ***Hand hygiene.*** Hands should be washed before and after palpating insertion sites or accessing, replacing or dressing a catheter. Process changes can improve compliance in this area and are easy to implement: include hand hygiene on the checklist for central lines, keep alcohol-based hygiene dispensers prominently placed, and post signs on patient rooms as reminders to staff.
- ***Maximal barrier precautions.*** One study found that the odds of developing CLABSI were six times higher when the line was placed without maximal barrier precautions. These precautions involve covering the patient with a large sterile drape, with a small opening at the insertion site. For clinicians, it means using a mask, cap, sterile gown and sterile gloves, the same as for surgical procedures. The best way to ensure compliance with this precaution is to keep all necessary equipment stocked together, to avoid the difficulty of hunting down supplies.
- ***Chlorhexidine skin antisepsis.*** Research shows that chlorhexidine provides better protection from infection than other antiseptic agents. It should be applied to the insertion site using a back-and-forth friction scrub for at least 30 seconds, and allowed to dry completely before the line is inserted. Again, it's easy to enhance compliance by including this step on the central line checklist and keeping chlorhexidine solution handy where central line equipment is stored – note that many prepackaged central line kits include povodine-iodine solution instead, even though the IHI recommends avoiding its use at catheter insertion sites.
- ***Optimal catheter site selection.*** Evidence-based guidelines recommend avoiding the femoral vein for catheter insertion in adult patients, as studies have shown this site correlates with higher infection rates. Some research indicates that use of the subclavian site correlates with lower infection rates than does the jugular insertion site. However, the bundle approach is based solely on lowering the likelihood of CLABSI, and recognizes that other medical factors should be considered when deciding where to place the line. (A physician should do a risk/benefit analysis as to which insertion site is most appropriate for the individual patient, with input from care team members.)
- ***Daily assessment of central line necessity.*** The goal here is to promptly remove lines that are no longer clearly needed for optimal care of the patient – and not to leave them in place for convenient access. The risk of infection increases over time as the line remains in place. (When central lines are placed for long-term use, as in chemotherapy, weekly review of necessity may be appropriate.)

Other elements of prevention, such as daily site care regimens and selection of dressing materials, are not included in the central line bundle but are likely

to be prescribed by protocols designed by a hospital's infection control team, based on the research literature and on CDC recommendations. Nursing staff should follow these as well, and incorporate them into checklists and workflows.

RESOURCES

- The CDC has issued its 2011 Guidelines for the Prevention of Intravascular Catheter-Related Infections (PDF). This is a detailed, highly technical document most suitable for infection control staff members who are accountable for developing protocols and training clinicians in their use.
- Another very detailed, outline-styled summary of evidence-based prevention techniques is found in *Strategies to Prevent Central Line-Associated Bloodstreamt Infections in Acute Care Hospitals*, a joint publication from the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA).
- The IHI provides a central line insertion checklist for download (PDF; free registration required).
- The IHI provides a clearly written, comprehensive view of implementing the central line bundle and tracking improvements in its How-to Guide: Prevent Central Line-Associated Bloodstream Infection (PDF; free registration required).

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