

Study of Healthcare-associated Infections

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ABSTRACT

Management of hospital-acquired infection is a very important aspect of healthcare management. A nosocomial infection affects approximately 2 million patients annually in acute care facilities in our country and their annual patient care costs several millions of rupees. Studies shows that nearly one-third of nosocomial infections can be prevented by a well-organized infection control program. But only <10% are actually prevented. Healthcare waste is an important source of healthcare-associated infection (HAI) and should be considered as a reservoir of pathogenic microorganisms, which can cause contamination and give rise to infection. If waste is inadequately managed, these microorganisms can be transmitted by direct contact, air or by a variety of vectors. Infectious waste contributes in this way to the risk of nosocomial infections, putting the health of hospital personnel and patients, at risk. The aim of the Hospital Infection Control Program is dissemination of information, surveillance activities, investigation, prevention and control of nosocomial infections in the hospitals.

Keywords: Hospital-acquired infection, hospital waste management, Hospital Infection Control Committee

This study describes the measures taken in a tertiary care hospital to control infection and its effect. There are big human and economic burdens of healthcare-associated infections (HAIs). The appropriate resources and activities required for an effective Infection Prevention and Control Program (IPCP) are very important to minimize the incidence and adverse outcomes of these infections.

The goals of IPCPs are to minimize these and other negative effects by contributing to patient safety through protecting patients from infections; protecting healthcare workers and visitors to healthcare facilities from infections; and accomplishing these goals in the most cost-effective manner whenever possible, thus reducing the economic impacts of HAIs on individual health facilities, health systems and the national healthcare industry.

HAIs occur in relation to healthcare interventions including invasive, diagnostic, surgical and medical procedures. Examples of HAIs include bloodstream,

surgical site, urinary tract, pulmonary and skin and soft tissue infections. Transmission of infectious diseases, such as SARS, tuberculosis, influenza, *Clostridium difficile* (*C. difficile*), norovirus and antibiotic-resistant organisms (e.g., MRSA [methicillin-resistant *Staphylococcus aureus*] and VRE [vancomycin-resistant enterococci]) to patients within the healthcare delivery system are also considered HAIs.

IPCPs were first introduced in the 1950s. Initially referred to as Infection Control Programs, these hospital-based programs focused on the control of hospital-acquired infections, which were referred to as nosocomial infections. As healthcare increased in complexity and sophistication and expanded beyond acute care, the mandate of IPCPs should have expanded to encompass infections in all settings across the healthcare continuum. Contrary to expectations; however, IPCPs have seen their resources either decrease or remain static and consequently have failed to achieve the needs of the expanding mandate.

HAIs contribute to significant morbidity, mortality and economic costs and the risk of hospital-acquired infections is increasing. These infections are the most common complication affecting hospitalized patients. Effective IPCPs reduce nosocomial infections by at least 30% and have repeatedly been shown to be effective in controlling infection outbreaks in the healthcare setting. Appropriate resources, both in quantity and in quality, are required to support effective IPCPs.

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AIM OF THE STUDY

The aim of the study is to see the effect of Hospital Infection Control Program in the intensive care unit (ICU) of a tertiary care hospital.

MATERIAL AND METHODS

This study was conducted in the ICU of a tertiary care super specialty hospital (Indian Spinal Injuries Centre) by observing and monitoring the effect of implementing Hospital Infection Control Program in postoperative cases over a period of 7 days from the date of surgery. Indian Spinal Injuries Centre is a tertiary care specialized center for spinal injury patient, orthopedics and joint replacement.

Infection Control Program

Hospital control program team consists of two infection control nurses and one infection control officer (microbiologist) who are responsible for infection control work. There is a multidisciplinary Hospital Infection Control Committee chaired by medical superintendent and microbiologist is the member secretary and other members are from different clinical and nonclinical specialties, nursing and housekeeping.

REVIEW OF LITERATURE

A nosocomial infection (derived from the Greek words *nosos* [disease] and *komein* [to care for], and later the Latin word for hospital nosocomium) is defined as an "Infection that is not present or incubating when the patient is admitted to hospital or other healthcare facility".

The time frame for diagnosis of a nosocomial infection will thus clearly be dependent on the incubation period of the specific infection; 48-72 hours after admission is generally deemed indicative of nosocomial, rather than community-acquired infection.

Although generally associated with hospital admission (hence the term hospital-acquired infection), nosocomial infections can arise after admission to any healthcare facility and the term HAI is increasingly being used. Such infections are common and associated with great morbidity and mortality. Indeed, one provocative headline stated "Hospital-acquired infections kill 5,000 patients a year in England".

The information for this news piece was taken from a government report on hospital-acquired infection in England, which suggested that there are at least 1,00,000 cases of hospital-acquired infection every

year in England, costing the UK National Health Service some £1 billion each year. In addition to their association with increased morbidity and mortality, nosocomial infections are frequently associated with drug-resistant microorganisms, including MRSA and extended-spectrum β -lactamase (ESBL)-producing Gram-negative bacteria, which can pose considerable therapeutic problems.

Medicolegal issues can also arise, since patients or their families sometimes blame the hospital or staff for the infection, and demand compensation. Nosocomial infections can affect any part of the body, but respiratory tract infections are most frequent, followed by central line infections, urinary tract infections and wound infections.

PATHOPHYSIOLOGY

The development of nosocomial infection is dependent on two key pathophysiological factors: decreased host defences and colonization by pathogenic, or potentially pathogenic, bacteria.

Although these two factors can arise independently, for infection to result both must be present to some degree. Direct contact can include spread from the hands of healthcare workers or visitors, but also from contaminated equipment and infusions.

UNDERLYING HEALTH IMPAIRMENT

Certain conditions predispose to bacterial colonization, and hence nosocomial infection, by impairing host-defense mechanisms. Patients with chronic lung disease are at an increased risk of developing nosocomial infection. Poor nutrition and chronic debilitation are associated with reduced immune defense, explaining the increased risk of nosocomial infections in such patients.

THE ACUTE DISEASE PROCESS

The underlying disease process as well as the severity of disease can affect the risk of developing nosocomial infection. Patients with a primary diagnosis of trauma or burns are at an increased risk. Trauma patients too have altered immune responses, making them more likely to develop infection.

Perhaps unsurprisingly, severity of illness as assessed by severity scores has also been associated with the development of nosocomial infection, but rather associated with other risk factors for infection, such as prolonged length of stay.

INVASIVE DEVICES

In a report from the National Nosocomial Infection Surveillance (NNIS) system, involving data from 4,98,998 patients, 83% of episodes of nosocomial pneumonia were associated with mechanical ventilation, 97% of urinary tract infections arose in patients with a urinary catheter in place and 87% of primary bloodstream infections were in patients with a central line.

TREATMENT METHODS

Various therapeutic strategies are associated with a raised risk of nosocomial infection. Cook and colleagues noted that the administration of paralytic agents was an independent predictor of nosocomial pneumonia in their study of 1,014 mechanically ventilated patients. Sedative drugs, corticotherapy, antacids, stress-ulcer prophylaxis, previous antibiotic therapy and multiple blood transfusions have all been identified as risk factors.

EPIDEMIOLOGY

The quoted incidence of nosocomial infection varies, according to the setting i.e., the type of hospital or ICU the population of patients, and the precise definition used (hospital-acquired, ICU acquired, nosocomial pneumonia). One of the largest databases related to nosocomial infection in intensive care. In this 1-day point prevalence study, information was obtained on all patients who occupied a bed in an ICU over 24 hours in 1992: 10,038 patients were recruited from 1,417 western European ICU. Of these patients, 4,501 were infected and of those 2,064 (21% of the total number) had an ICU-acquired infection. There was a relation between the prevalence of nosocomial infection and mortality according to country, with greater incidence of infection and higher mortality rates in the southern European countries of Portugal and Greece than in Scandinavia and Switzerland (Fig. 1).

Other studies have quoted incidence rates between 9% and 37%, dependent largely on the populations studied and the definitions used. Differences in surveillance techniques can also affect detection of nosocomial infection and, hence, rates. However, we are becoming less invasive in our treatment techniques (less aggressive surgical procedures are used, fewer Swan-Ganz catheters are being placed, noninvasive mechanical ventilation is being applied when possible and appropriate) and are more aware of techniques that could prevent nosocomial infection

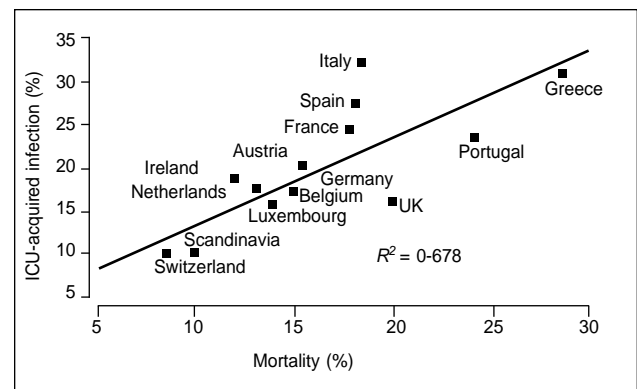


Figure 1. Correlation between prevalence rate of ICU-acquired infection and mortality rate by country.

(antibiotic-coated catheters, avoidance of nasotracheal intubation thus limiting sinusitis), which could result in a reduced incidence of infections. In a study on one ICU, comparing data over 25 years, the incidence of bacteremia increased from 1.8% in 1971-75 to 5.5% in 1991-95, with the largest increase seen between 1986-90 and 1991-95. Dagan and co-workers, however, reported a fall in the nosocomial infection ratio from 25.2% in 1987 to 20% in 1992.

EFFECT OF NOSOCOMIAL INFECTION

The effect of nosocomial infection in terms of morbidity, mortality and increased resource use is substantial. Nosocomial infection is associated with an increased length of stay, which results in an additional cost of about US\$ 3.5 billion per year, without taking into account antibiotic or other therapeutic costs. Crude mortality rates associated with nosocomial infection vary from 12% to 80%, dependent on the population studied and the definitions used.

ORGANISMS

Any organism can be implicated in nosocomial infection, and many infections are polymicrobial. Recent years have seen a swing in the pattern of infecting organisms towards Gram-positive infections. The surveillance and control of pathogens of epidemiologic importance (SCOPE) project data revealed that Gram-positive cocci were isolated in 64% of 10,617 episodes of nosocomial bacteremia, whereas Gram-negative bacilli were isolated in only 27% of cases.

The EPIC study identified the following as the most commonly reported nosocomial pathogens: *S. aureus* (30%), *Pseudomonas aeruginosa* (29%), coagulase-negative staphylococci (19%), yeasts (17%), *Escherichia coli*

(13%), enterococci (12%), *Acinetobacter* spp. (9%) and *Klebsiella* spp. (8%). Other studies have noted similar patterns of causative microorganisms.

ANTIMICROBIAL RESISTANCE

Antimicrobial resistance patients who remain in hospital for long periods can have successive infections and are more likely to develop nosocomial infections due to resistant pathogens. In the EPIC study, 60% of the *S. aureus* for which methicillin resistance patterns were reported, were resistant (as high as 80% in Italy, France, and Greece), and 46% of *P. aeruginosa* were resistant to gentamicin. Legras and colleagues similarly reported that 58% of the *S. aureus* in their study in French ICUs were methicillin-resistant. The NNIS reports increased rates of resistance for many microorganisms when comparing data from 2000 with those pooled from the period 1995 to 1999 (Fig. 2).

One approach to try and reduce the frequency of resistant organisms is to use antibiotic rotation or cycling. Gruson and colleagues noted that antibiotic rotation and restricted use of ceftazidime and ciprofloxacin caused a fall in the number of cases of VAP-associated with resistant Gram-negative bacilli, and an increase in the numbers of methicillin-sensitive *S. aureus*.

Raymond and co-workers introduced a quarterly rotation of empirical antibiotics in their ICU and noted great reductions in the incidence of antibiotic-resistant Gram-positive coccal infections (7.8 infections per 100 admissions vs. 14.6 infections per 100 admissions, $p < 0.0001$), antibiotic-resistant Gram-negative bacillary infections (2.5 infections per 100 admissions vs. 7.7 infections per 100 admissions $p < 0.0001$), and mortality associated with infection (2.9 deaths per 100 admissions vs. 9.6 deaths per 100 admissions, $p < 0.0001$) during rotation. Other groups have reported similar benefits from such strategies, which require continued input from infectious disease specialists if they are to be employed effectively.

SPECIFIC NOSOCOMIAL INFECTIONS

Respiratory

The respiratory tract is the most common site of nosocomial infection in the ICU. In the EPIC study, pneumonia accounted for 47% of nosocomial infections, the figure rising to 65% if all respiratory infections were included.

Urinary Tract

This is the second most common site of nosocomial infection (accounting for 8-35% of infections), although the consequences of nosocomial urinary tract infection are usually less severe than for other types of nosocomial infection. Urinary tract infections are generally associated with the presence of a urinary catheter. Silver hydrogel-coated catheters might reduce the incidence of nosocomial urinary tract infection in general hospital patients, although results of several studies, including one in patients in intensive care, noted no significant differences.

Antibiotic-coated catheters (with nitrofurantoin or ciprofloxacin) have been effective in animals and *in vitro*, but no results from clinical tests have been published and concerns exist as to the effects of such catheters on the development of antimicrobial resistance. Prevention of nosocomial urinary tract infections should thus aim at avoiding catheter placement whenever possible, but when necessary, reducing the duration of catheterization.

Catheter-related Infections

Catheter-related bloodstream infections are associated with pronounced increases in length of time in ICU and hospital costs.

Other Sites

Nosocomial infections from other sources are generally decreasing in incidence. One good example of how change in practice can affect infection rates is the case of nosocomial sinusitis, a nosocomial infection specific to ICU. Results of studies indicate that nosocomial sinusitis, carrying an increased risk of nosocomial pneumonia, was significantly more common in patients with nasal devices, such as nasogastric or nasotracheal tubes, than in those without.

In a randomized trial, Rouby and colleagues reported that radiological sinusitis developed in 95% of patients intubated with a nasal tube compared with 23% in patients with an oral tube. Use of the orotracheal route for intubation, rather than the nasotracheal route, has reduced the incidence of nosocomial sinusitis.

FUTURE PERSPECTIVES

The roles of understaffing and staff composition as predisposing factors for nosocomial infection need to be emphasised. Fridkin and colleagues noted that the patient-to-nurse ratio was an independent risk factor for catheter-related bloodstream infection in

their population of surgical patients in intensive care. Infection surveillance can reduce nosocomial infection rates when incorporated with infection prevention programs, but needs to be improved and implemented and combined with continuing educational programs to encourage compliance with basic infection control procedures. Infection surveillance is increasingly undertaken and various surveillance systems have been developed.

DEFINITIONS OF HOSPITAL-ACQUIRED (NOSOCOMIAL) INFECTIONS

The Centers for Disease Control and Prevention (CDC) defined hospital infection as follows:

Hospital-acquired infection (nosocomial infection) is the occurrence of infection after hospital admission, without evidence that the infection was present or incubating at the time of admission. A nosocomial infection usually occurs within 30 days after hospital stay or within 1 year in case of infection associated with insertion of a prosthetic device.

Types of HAI: All types were recorded. Infections in more than one site in the same person were registered as separate infections.

The following are clinical infection categories:

- Urinary tract infection (excluding asymptomatic bacteriuria)
- Upper respiratory tract infection
- Lower respiratory tract infection
- Gastroenteritis
- Postoperative wound infection; incision site superficial
- Postoperative wound infection, deep-seated
- Skin and soft tissue infection, burn infection

- Skin and soft tissue infection, other infections
- Intra-abdominal infection
- Osteomyelitis
- Septicemia
- Meningitis
- Intravascular-access-device infection/infection in tracheal incision
- Infections in newborns.

OBSERVATIONS

This study shows that if IPCP is implemented and monitored it can bring down HAI even in a hospital treating spine injuries (Where patients are unable to take care and move hence there are more chances of infection) (Table 1 and Fig. 2).

DISCUSSION

Impacts of HAIs: An Overview

Society as a whole suffers negative consequences from HAIs. These infections, including their investigation and treatment, have both immediate and future implications

Table 1. Infection Control Data for Indian Spinal Injuries Centre

	Dec 11	Jan 12	Feb 12	March 12	April 12	May 12
UTI	4.4	3.6	3.7	3.2	2.4	2
BSI	1.4	0.7	0	0	0	0
SSI	1.8	1.3	1.1	1	0.8	0.6
VAP	0	0	16.2	6.2	0	0

UTI = Urinary tract infection; BSI = Bloodstream infection; SSI = Surgical site infection; VAP = Ventilator-associated pneumonia.

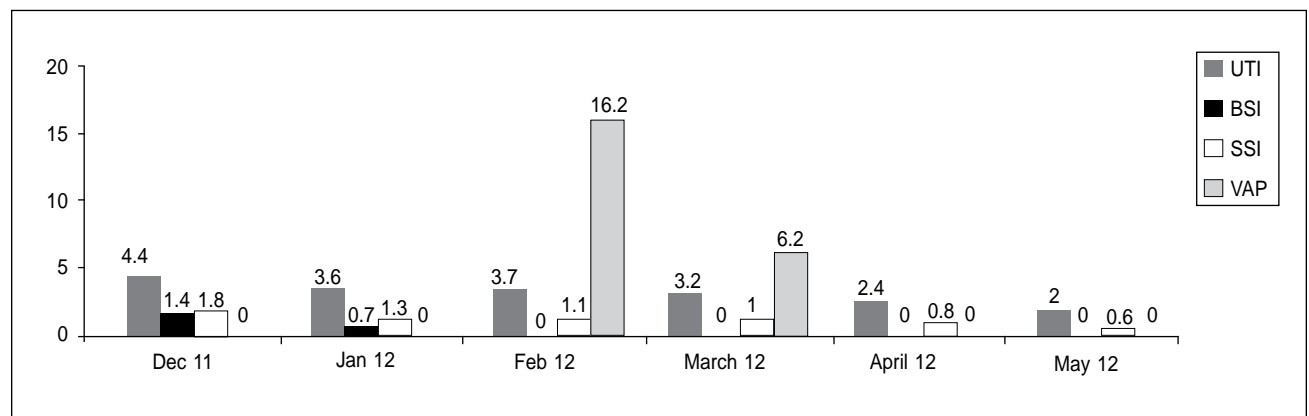


Figure 2. Infection control data for Indian Spinal Injuries Centre.

for the individual, the healthcare system, and the local, national and global communities. Although there are limited data describing the societal impact of HAIs, some emerging examples illustrate their breadth and gravity.

Costs and Rates of HAIs

The management of HAIs exacerbates rising healthcare costs, although the exact attributable cost to society is unknown. Related financial impacts of HAIs include an increased time away from home for the individual with an infection and if employed, the individual experiences loss of work and wages or at least an increased use of sick leave.

The indirect costs, such as a family members' time lost from work in caring for the affected individual, must be considered in addition to the direct costs of increased use of resources, but have not been well-quantified. Overall, HAIs have a detrimental effect on the individual's quality-of-life and are very costly. The HAI financial burden to the healthcare system has been estimated by measuring a number of indices including increased:

- Number of readmissions to hospital
- Length of stay
- Use of antimicrobials
- Surveillance and isolation measures for AROs
- Laboratory and radiological services attributable to diagnosing and managing HAIs
- Overall direct or indirect costs
- Cost attributable to outbreaks.

Effective infection control program should include the following:

- Organized surveillance and control activities
- One infection control practitioner for every major Health Facility
- A trained hospital epidemiologist
- A system for reporting surgical wound infection rates and other infection back to the practicing surgeons and physicians.

Essentials of the Standard Precautions to be Used in the Care of all Patients

Hand Hygiene

- Performed between patient contacts, after touching blood, secretions, excretions and contaminated items, whether or not gloves are worn.

Can be performed with:

- Alcoholic hand sanitizer
- Use of plain soap and water for routine hand washing.
- Use of antimicrobial agent for specific circumstances.

Gloves

- Wear gloves when touching blood, body fluids, secretions, excretions and contaminated items. Put on clean gloves just before touching mucous membranes and nonintact skin.

Mask, Eye Protection, Face Shield

- Wear a mask and eye protection or a face shield during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions.

Gown

- Wear a gown during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions.

Patient-care Equipment

- Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately.

Environmental Control

- Ensure that the hospital has adequate procedures for the routine care, cleaning and disinfection of environmental surfaces.

Linen

- Handle used linen, soiled with blood, body fluids, secretions and excretions in a manner that prevents skin and mucous membrane exposures and that avoids transfer of microorganisms to other patients and environments.

Occupational Health and Blood Borne Pathogens

- Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices.
- Use ventilation devices as an alternative to mouth-to-mouth resuscitation methods.

Place of Care of the Patient

- Place a patient, who contaminates the environment or who does not assist in maintaining appropriate hygiene, in an isolated (or separate) room.

Goals for Infection Control

There are three principal goals for hospital infection control and prevention programs regardless of the healthcare setting or service mix:

- Protect the patient
- Protect the healthcare worker, visitors and others in the healthcare environment
- Accomplish the previous goals in a timely, efficient, and cost-effective manner, whenever possible.

Priority Outcome Areas

The priority outcome areas identified are:

- Management commitment, leadership and accountability
- Monitoring infection control and reducing infection rates
- Prevention of adverse events
- Protecting healthcare workers and visitors
- Surveillance.

Management Commitment, Leadership and Accountability

The hospital management is responsible for ensuring management supports and allocates appropriate resources for effective prevention, monitoring and control of infection.

Prevent Adverse Events

The hospital management has a risk management approach and ensures that senior management support an effective risk management program, which incorporates strategies for addressing infection control issues.

Monitor IC and Reduce Infection Rates

Interruption of the transmission of or potential transmission of infectious disease, outbreak investigations and control, and performance improvement activities.

Protect Staff and Visitors

The hospital management is responsible for the provision of a safe environment for patients, staff and visitors.

Surveillance

There is a defined program for nosocomial infection surveillance which includes the collection, analysis and reporting back of data to those who need to know and take action. The Infection Control Team and

Hospital Infection Control Committee play a major role in this. HAI rates could be reduced over a period of 6 months by simple approach like implementing and monitoring hand hygiene compliance among staff and those handling the patients.

DO'S AND DON'TS

Infection Control

Do's

- Ensure that all isolation/cohort areas are supplied with gloves/gowns, aprons and hand-hygiene supplies.
- Encourage and facilitate hand-hygiene practices
- Ensure ongoing and terminal cleaning of isolation areas.

Don'ts

- Transfer isolated/cohorted individual unless clinically essential.
- Prolong patient's placement in isolation area on cessation of symptoms/clearance of specimens/completion of treatment and/or advice by specialist.

Infection Control in Healthcare Environment Cleaning of Patient Care Devices

Do's

- Perform most cleaning, disinfection and sterilization of patient-care devices in a central processing department in order to control quality.
- Meticulously clean patient-care items with water and detergent or with water and enzymatic cleaners before high-level disinfection or sterilization procedures.
- Remove visible organic residue (e.g., residue of blood and tissue) and inorganic salts with cleaning.
- Use cleaning agents that are capable of removing visible organic and inorganic residues.
- Clean medical devices as soon as possible after use (e.g. at the point of use because soiled materials become dried onto the instruments). Dried or baked materials on the instrument make the removal process more difficult.
- Perform either manual cleaning (i.e., using friction) or mechanical cleaning (e.g., with ultrasonic cleaners, washer-disinfector, washer-sterilisers).
- Inspect equipment surfaces for breaks in integrity that can impair either cleaning or disinfection/sterilization.

Disinfectant Fogging

Don't

- ⊖ Perform disinfectant fogging for routine purposes in patient-care areas.

Disposal of Biohazard Materials

Do's

- ⊕ Ensure segregation of waste at point of origin into designated colored bags depending on type of waste as per BMW (Management of Handling Rules, 1998).
- ⊕ Ensure that janitor wears gloves, mask, apron when handling biomedical waste.
- ⊕ Bag all used linen at point of origin. While changing linen avoid unnecessary agitation.
- ⊕ Bag all linen, tie it up and keep aside.
- ⊕ Use dedicated trolley for waste and for used linen.
- ⊕ Disinfect waste trolley with FDA approved disinfectant after each use.
- ⊕ Use material that do not generate fumes in wards and critical care units.
- ⊕ Discard sharps in the dedicated sharps container.

Best Practices for Prevention and Monitoring of Catheter-associated Urinary Tract Infections

Do's

Limit the use of indwelling urethral catheters to the following:

- ⊕ Perioperative use for selected surgical procedures
- ⊕ Urine output monitoring in critically ill patients
- ⊕ Management of acute urinary retention and urinary obstruction
- ⊕ Assistance in pressure ulcer healing for incontinence
- ⊕ Properly secure indwelling catheters after insertion
- ⊕ Maintain a sterile, continuously closed drainage system
- ⊕ Collect a small sample of fresh urine for examination by aspirating urine from the sampling port with a sterile needle and syringe after cleansing the port with disinfectant
- ⊕ Maintain unobstructed urine flow
- ⊕ Empty the collecting bag regularly, using a separate collecting container for each patient
- ⊕ Keep the collecting bag below the level of the bladder at all times.

Don'ts

- ⊖ Disconnect the catheter and drainage tube unless the catheter requires irrigation.
- ⊖ Screen for asymptomatic bacteriuria in catheterized patients.
- ⊖ Treat asymptomatic bacteriuria in catheterized patients except before invasive urologic procedures.
- ⊖ Irrigate catheter.
- ⊖ Perform continuous irrigation of the bladder with antimicrobials as a routine infection prevention measure.
- ⊖ Use systemic antimicrobials routinely as prophylaxis.
- ⊖ Change catheters frequently.
- ⊖ Routinely use silver-coated or other antibacterial catheters.

Best Practices for Prevention and Monitoring of Surgical Site Infections

Do's

- ⊕ Keep preoperative hospital stay as short as possible.
- ⊕ Control serum blood glucose level in all diabetic patients adequately.
- ⊕ Use electric clippers rather than razors or depilatories for hair removal. Hair should be removed immediately before the operation.
- ⊕ Use an acceptable antiseptic agent for skin preparation, such as alcohol (usually 70-92%), chlorhexidine (4%, 2% or 0.5% in alcohol base) or iodine/iodophors (usually 10% aqueous with 1% iodine or with 7.5%).
- ⊕ Perform the surgical scrub for duration of 3-5 minutes.
- ⊕ Select a prophylactic antimicrobial agent based on its efficacy against the most common pathogens causing surgical site infection for a specific operation.
- ⊕ Administer a antimicrobial prophylaxis, ideally within 30 minutes, but not longer than 2 hours before the initial incision.
- ⊕ Maintain positive pressure ventilation in the operating room with respect to the corridors and adjacent areas.
- ⊕ Maintain a minimum of 15 air changes per hour in the operating room, of which at least 3 should be of fresh air.
- ⊕ Keep operating room doors closed except when needed for passage of equipment, personnel and the patient.

- Limit the number of personnel entering the operating room, to necessary ones only.
- Wet vacuum the operating room floor after the last operation of the day or in night with an EPA-approved hospital disinfectant.
- Protect an incision closed primarily with a sterile dressing for 24-48 hours postoperatively.
- Wash hands with an antiseptic agent before and after dressing changes or on any contact with the surgical site.
- Identify SSI using CDC definition without modification among surgical in patients and out patients.

Don'ts

- Extend antibiotic prophylaxis postoperatively.
- Routinely use vancomycin for prophylaxis.
- Perform special cleaning or disinfection of operating rooms after contaminated or dirty operations.
- Perform routine environmental sampling of the operating room. Perform microbiologic sampling of operating room environmental surfaces or air only as part of an epidemiologic investigation.
- Use flash sterilization for routine reprocessing of surgical instruments.

Best Practices for Prevention and Monitoring of Intravascular Catheter-related Infections

Do's

- Educate healthcare workers regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters.
- Observe hand hygiene before and after palpating catheter insertion sites, as well as before and after inserting, replacing, accessing, repairing or dressing an intravascular catheter.
- Maintain aseptic technique for the insertion and care of intravascular catheters.
- Disinfect clean skin with an appropriate antiseptic before catheter insertion and during dressing changes. Although a 2% chlorhexidine-based preparation is preferred, but tincture of iodine, an iodophor or 70% alcohol can also be used.
- Select the catheter, insertion technique and insertion site with the lowest risk for complications (infectious and noninfectious) for the anticipated type and duration of intravenous therapy (IV) therapy.

- Promptly remove any intravascular catheter that is no longer essential.
- Replace all catheters as soon as possible and after no longer than 48 hours when adherence to aseptic technique can not be ensured (i.e., when catheters are inserted during a medical emergency)
- Use a subclavian site (rather than a jugular or a femoral site) in adult patients to minimize infection risk for tunneled central venous catheter (CVC) placement.
- Conduct surveillance in ICUs and other patient populations to determine catheter-related bloodstream infection (CRBSI) rates, monitor trends in those rates and assist in identifying lapses in infection control practices.

Don'ts

- Routinely culture catheter tips.
- Routinely use arterial or venous cut down procedures as a method to insert catheters.
- Apply organic solvents (e.g., acetone and ether) to the skin before insertion of catheters or during dressing changes.
- Use topical antibiotic ointment or creams on insertion sites (except when using dialysis catheters) because of their potential to promote fungal infections and antimicrobial resistance.
- Routinely replace central venous or arterial catheters solely for the purposes of reducing the incidence of infection.
- Routinely replace venous catheters in patients who are bacteremic or fungemic if the source of infection is unlikely to be the catheter.
- Use filters routinely for infection-control purposes.
- Administer intranasal or systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or bloodstream infection.
- Routinely use antibiotic lock solutions to prevent CRBSI. Use prophylactic antibiotic lock solution only in special circumstances (e.g. in treating a patient with a long-term cuffed or tunneled catheter or port, having a history of multiple CRBSIs despite optimal maximal adherence to aseptic technique.

CONCLUSION

HAIs increased morbidity, mortality and resource expenditure throughout the hospital setting and particularly in the ICU. A multidisciplinary approach to prevention that involves the whole intensive-care team including management is essential if we are to succeed

in preventing infections. Awareness of risk factors and attention to simple preventive measures such as hand hygiene can reduce the incidence and effect of these infections.

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⊘ Allergic Cough

⊘ Cough with RTI

⊘ Smoker's Cough

⊘ Cough with Bronchial Asthma and Bronchitis

⊘ Drug Induced Cough

⊘ Cough with LPRD/GERD*

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