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Central Line: Associated Blood Stream Infection

Shibilamol C Baby

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Abstract

HAIs are resulting from complications of healthcare. They are linked with high morbidity and mortality. On any given day, 1 in 31 hospital patients has an HAI (an infection while being treated in a medical facility). It is one of the most emerging problems in health care. Additional infections occur in other healthcare settings. Seriously ill patients are particularly vulnerable to serious complications due to HAIs, likely due to factors such as progressively more invasive medical technology and complex medical procedures, increasing immunocompromised status and elderly age, and the rising incidence of antimicrobial resistance. The encouraging news is that many HAIs are preventable when evidence based guidelines are incorporated into patient care. Patients who get a CLABSI have a fever, and might also have red skin and soreness around the central line. If this happens, healthcare providers can do tests to learn if there is an infection present. Healthcare providers must follow a strict protocol when inserting the line to make sure the line remains sterile and a CLABSI does not occur. In addition to inserting the central line properly, healthcare providers must use stringent infection control practices each time they check the line or change the dressing.

Keywords: CLABSI - Central Line Associated Blood Stream Infection

WHO - World Health Organization

CDCP - Centers for Disease Control and Prevention

CVC - Central Venous Catheter

HAIs - Healthcare-Associated Infections

INTRODUCTION

Infections that patients develop while they are receiving care in a health care setting for another condition are termed health care associated infections (HAIs). HAIs occur through out the world, affecting hundreds of millions of patients each year. These infections are not only costly to individuals and health care systems; they can significantly increase morbidity and mortality in developed countries and in developing countries. The CDC estimates that 5% to 10% of hospitalized patients develop an HAI. There were an estimated 1.7 million infections and 99,000 associated deaths in hospitals in 2002. Another estimated 1.6 million to 3.8 million infections occur in long term care facilities each year.

A central line associated bloodstream infection (CLABSI) is a serious infection that occurs when germs (usually bacteria or viruses) enter the bloodstream through the central line. It has been estimated that 80,000 CLABSIs occur in ICUs in the

Authors Affiliation: Nurse Educator, Department of Quality, Sun Medical And Research Center, Thrissur 680001, Kerala, India.

Coressponding Author: Shibilamol C Baby, Nurse Educator, Department of Quality, Sun Medical And Research Center, Thrissur 680001, Kerala, India.

E-mail: shibilachirayath@gmail.com

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United States each year; however, if patients outside ICUs are also included, the estimate increases to 250,000 cases of CLABSI each year.

Content

Reasons for the differences in the degree of burden of HAIs in developing countries include the following:

- Limited knowledge and training in basic infection prevention and control.
- Limited awareness of the dangers associated with HAIs.
- In adequate infrastructure and limited resources.
- Poor adherence to routine hand hygiene.
- Reuse of equipment (for example, needles, gloves).
- Poor environmental hygiene and over crowding.
- Understaffing.
- Inappropriate and prolonged use of antimicrobials and invasive devices.
- Limited local and national policies and guidelines.
- Variable adherence to official regulations or legal frameworks, where they exist.
- In sufficient administrative support.

Types of CVCs

Nontunneled catheters are inserted into the subclavian, jugular, or femoral vein via a peripheral venipuncture, and the catheter tip is advanced until it rests in the superior vena cava. These short-term (used less than three weeks) catheters may be made of silicone or polyurethane. They can be inserted in out patient or in patient settings and can be exchanged over a guide wire. They are used to measure central venous pressure and for the administration of fluids and/or hyper or hypoosmolar drugs in patients with limited peripheral access and for short-term hemodialysis.

Tunneled CVCs, such as Hickman and Broviac catheters, are long-term (used weeks to months) catheters that are inserted into a vein at one location (such as the jugular or subclavian vein) that are then surgically tunneled under the skin to exit the body several inches away from the vein. The tip of the catheter rests in the lower third of the superior vena cava at the right atrial junction. The proximal end exits the subcutaneous tunnel at the lower anterior chest wall and is equipped with a Dacron cuff that sits within the skin tunnel. The cuff induces an inflammatory response that results in the growth of fibrous tissue that anchors the catheter in place. The cuff also acts as a mechanical barrier to micro organisms.

Implantable ports, such as portacaths, are surgically placed completely under the skin, usually as a central subclavian port in the subcutaneous pocket of the upper chest wall. These are useful for long-term or permanent vascular access and carry with them a lower infection risk, as they are not external to the body.

Peripherally inserted central catheters (PICCs), PICCs are inserted into a vein in the arm (usually the basilic, brachial, or cephalic vein) rather than a vein in the neck or chest. The catheter is then advanced to the distal superior vena cava/proximal right atrium. PICCs are made of polyurethane or silicone.

Risk Factors

Intrinsic risk factors

- *Age:* CLABSIs rates are higher among children than adults, particularly in neonates.
- Underlying diseases or conditions hematological and immunological deficiencies, cardiovascular disease, and gastrointestinal diseases have been associated with an increased risk for CLABSI.
- Male gender has been identified as a factor associated with increased risk of CLABSI.

Potentially modifiable risk factors

- Prolonged hospitalization before CVC insertion.
- Multiple CVCs.
- CVC duration, with the risk increasing with CVCd well time.

- Parenteral nutrition administration.
- Femoral or internal jugular access site rather than subclavian in adult patient.
- Heavy microbial colonization at insertion site, Multi lumen CVCs.
- Lack of maximal sterile barriers (cap, mask, sterile gown, sterile gloves, and a sterile full body drape) for the insertion of CVCs or guidewire exchange.
- CVC insertion in an ICU or emergency department.

Preventions

- Hand Hygiene
- Aseptic Technique
- CVC Insertion Preparation
- Maximal Sterile Barrier Precautions

Maximal sterile barrier (MSB) precautions require the CVC inserter to wear a mask and cap, a sterile gown, and sterile gloves and to use a large (head-to-toe) sterile drape over the patient during the placement of a CVC or exchange of a catheter over a guidewire.

Skin preparations

- Apply antiseptics to clean skin.
- Apply chlorhexidine/alcohol in a concentration greater than 0.5% in alcohol.
- If there is a contraindication to chlorhexidine, apply tincture of iodine, an iodophor, or alcohol as an alternative.
- Allow the antiseptic solution to dry before placing the catheter.

Use of Catheter Kits or Carts

Having standardized supply carts or kits with all the necessary CVC insertion and care supplies and equipment in "ready to go" locations saves health care personnel time and helps ensure that the correct supplies and equipment are used for all insertion and maintenance procedures. It is essential that the carts or kits are always stocked and readily accessible. Procedures should be established for used carts to be switched out in a timely manner for newly cleaned and stocked carts. Kits can be kept in unit supply rooms, at nurse's station.

CVC Insertion

After the appropriate preparations have been made, the insertion process may begin. As described in the sections that follow, this process includes catheter site selection, insertion under ultrasound guidance, catheter site dressing regimens, securement devices, and use of a CVC insertion bundle.

Catheter Site Selection

WHO suggest that the greatest risk of infection in adults is associated with use of the femoral vein as the insertion site, and the lowest risk is associated with subclavian site insertions, with an intermediate level of risk associated with internal jugular vein insertions for non tunneled CVCs. In pediatric patients, however, femoral catheters have a lower rate of mechanical complications and seem to have an equivalent infection rate to nonfemoral catheters.

- Catheter Site Dressing Regimens
- Securement Devices
- Use of a CVC Insertion Bundle

Catheter Care Bundle for Prevention of Central Line Associated Infection (CLABSI) A catheter care "bundle" includes the provision of care using a standard combination of interventions to prevent central line associated blood stream infections (CLABSIs). The components of the CL insertion bundle include the following practices: 1) hand hygiene prior to insertion; 2) maximal barrier precautions; 3) chlorhexidine skin antisepsis; 4) optimal site selection (avoidance of femoral vein in adults); and 5) daily review of line necessity.

CVC Maintenance

Proper maintenance of CVCs is essential for continued patient safety. The sections that follow discuss the use of prophylactic lock and flush solutions; disinfection of catheter hubs, connectors, and injection ports; chlorhexidine bathing; and use of a CVC maintenance bundle.

Prophylactic Antibiotic Lock Solutions, Anti-microbial Flush Solutions, and Catheter Lock Solutions

A wide variety of antibiotic and antiseptic solutions have been used to lock or flush CVC lumens. Catheter lock is a technique by which an antimicrobial solution is injected into the catheter lumen dead space until it is filled and then allowed to well for a period of time, until the catheter is accessed again.

Disinfection of Catheter Hubs, Connectors, and Injection Ports

The external surface of a catheter hub, connector, or injection port is the immediate portal of entry of microorganisms to the intraluminal surface of the catheter.

- The microbial burden on the surface of the access sites.
- The antiseptic agent used Chlorhexidine/ alcohol solutions appears to be most effective in reducing colonization.
- The concentration of the antiseptic agent. The higher the concentration of the agent, the more rapid the antimicrobial eradication.
- The amount of contact time between the surface and the antiseptic agent.
- The method of application - wipe, clean, disinfect, scrub.

Chlorhexidine Bathing

Recently the innovative practice of bathing patients who have CVCs with chlorhexidine as a total body bathing solution has been studied as a strategy to lower CLABSI rates. The rationale for the use of chlorhexidine bathing in place of soap and water bathing relates to the patient's resident skin flora that can enter the blood stream at the CVC insertion site or the extra luminal surface of the catheter.

Removal or Replacement of Catheters or System

Components Health care personnel must ensure that a patient's central venous catheter is removed or replaced at the appropriate time and in a safe manner. The following sections discuss daily review of line necessity, changing administration system components, and CVC exchanges over a guidewire.

- Daily Review of Line
- Vascular access team
- CLABSI education programme
- CVC Exchanges over a Guidewire

Abbreviations (If Necessary)

CLABSI, CVC, ICU

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