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PREVENTING HEALTHCARE-ASSOCIATED INFECTIONS IN CARDIAC SURGICAL PATIENTS AS A HALLMARK OF EXCELLENCE

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Introduction

Healthcare-associated infections (HAI) are the tenth-leading cause of death in the United States.[1] The Centers for Disease Control and Prevention (CDC) estimate that HAIs annually account for 1.7 million infections, 99,000 associated deaths, and a cost of approximately $30 billion.[2, 3] Nonreimbursement of some of these HAIs by the Centers for Medicare and Medicaid Services, public reporting of data (currently in 27 states), and the statistics listed above are driving quality initiatives to reduce or eliminate HAIs. However, a 2009 report from the Agency for Healthcare Research & Quality showed that little progress has been made towards eliminating HAIs.[2] Reducing the risk of healthcare-associated infections is the Joint Commission's National Patient Safety Goal Number 7.[4]

Cardiac surgery has always been at the leading edge of innovation and quality care. Improvements in this field have been brought about by the needs of critically ill patients who are at high risk of death and by leaders such as Dr. Michael DeBakey who were driven to provide excellence in patient care. One of the prime examples of quality initiatives in cardiac surgery has been the development of the Society of Thoracic Surgeons (STS) National Database. This has helped to develop benchmarks by which different institutions are measured. The STS database will lead another initiative by providing public presentation of hospital- and surgeon-specific data in the near future.[5] Even so, cardiac surgery patients are at especially high risk of developing HAIs.

Use of invasive devices such as central lines, urinary catheters, ventilators, etc. — all of which are commonly utilized in the care of cardiac surgical patients — is one of the most significant risk factors for acquiring HAIs. Cardiac patients also have significant co-morbidities such as diabetes, obesity, increasing frailty, advanced age, and multiple redo-operations. This combination makes our patients more vulnerable to HAIs. Accordingly, in 2010 the Society of Cardiovascular Anesthesiologists (SCA) Foundation launched the FOCUS (Flawless Operative Cardiovascular Unified Systems) Cardiac Surgery Patient Safety Initiative to help eliminate infections in cardiac surgery patients, especially catheter-related infections.[6] This publication will briefly discuss the four most common infections and strategies to reduce HAIs and will touch on some of the infection-control experiences from the Methodist DeBakey Heart & Vascular Center (MDHVC).

Catheter-Related Bloodstream Infections (CRBSI)

It is estimated that each year in the United States there are approximately 80,000 cases of catheter- related bloodstream infections (CRBSIs), resulting in 28,000 deaths.[7] The associated average cost is estimated at $45,000, with an annual $2.3 billion cost to the healthcare system.[7] Many initiatives at the local, state, and national levels, such as the Institute for Healthcare Improvement (IHI) Central Line Bundle, the CDC, the ACCP's Critical Care Collaborative and Stop BSI have been launched to reduce CRBSIs. Despite these initiatives, findings in July 2010 by the Association for Professionals in Infection Control and Epidemiology (APIC) showed that half of those surveyed agree that catheter-related bloodstream infections continue to be a problem in their facilities and cite lack of time, resources, and commitment of hospital leadership as hindering their ability to combat these infections more aggressively.[8] Updated guidelines for preventing CRBSI (Table 1) have been developed and are recommended. Likewise, many institutions have taken a proactive approach to reducing/eliminating CRBSI and have been quite successful in using concepts such as the CRBSI checklist and care bundles and taking a team approach to the problem.

Major areas of emphasis of these evidence-based guidelines include:
• Educating and training healthcare personnel who insert and maintain catheters.
• Using maximal sterile barrier precautions during central venous catheter insertion.
• Using a 2% chlorhexidine preparation for skin antisepsis.
• Avoiding routine replacement of central venous catheters as a strategy to prevent infection.
• Using antiseptic/antibiotic impregnated short-term central venous catheters and chlorhexidine impregnated sponge dressings if the rate of infection is high despite adherence to other strategies (i.e., education and training, maximal sterile barrier precautions, and 2% chlorhexidine for skin antisepsis).
• Implementing bundled strategies, documenting, and reporting rates of compliance with all components of the bundle as benchmarks for quality assurance and performance improvement.

Table 1. Draft guidelines for the prevention of intravascular catheter-related infections, replacing those published in 2002.[7] Source: Guide to the elimination of catheter-associated urinary tract infections, APIC, 2008. Reprinted with permission from APIC.

Surgical Site Infections

There are approximately 500,000 cases of surgical site infections (SSI) in the country each year.[9] Mortality is 2–11 times higher in patients who develop SSI.[9] Length of stay (LOS) increases by 7–10 postoperative days with an added cost of approximately $11,874–$34,670.[3, 6] Cardiac patients are at high risk secondary to long incisions and mechanical devices. Some examples of this are from studies by Darouiche, which showed that 85,000 heart valves/year with a rate of infection of 3,400/year had an average medical and surgical cost of treatment of $50,000.[10, 11] Vascular grafts had 16,000 infections/year with an average medical and surgical treatment cost of $40,000.[10, 11] Medicare does not cover the costs of CABG-associated mediastinitis.[12] According to the IHI, approximately 40–60% of all SSIs are preventable.[13] Risk factors include smoking, age, obesity, preexisting infections, improper hair removal or antibiotic administration, glucose control, surgical scrub, surgical instrument sterilization technique, and temperature. SSI prevention strategies include those listed in Table 2. Implementing these strategies consistently and routinely will reduce SSIs.

Smoking cessation
Hand hygiene
Preoperative chlorhexidine shower
Appropriate hair removal
Equipment/environmental cleaning
Antibiotic prophylaxis
Skin antisepsis 2% CHG*
Surgical technique
Normothermia
Maintenance of O_2
Minimizing operating time and traffic
Data feedback

** CHG: chlorhexidine gluconate*

Table 2. SSI – Steps for Reduction

Catheter-Associated Urinary Tract Infections

Catheter-associated urinary tract infections (CAUTI) are the most common HAIs, making up approximately 36% of all hospital HAIs.[14] We are a Foley catheter-loving nation, with estimates of about 30 million catheters inserted annually in the United States.[15] Mortality and morbidity from CAUTI is lower compared to other HAIs; however, the approximately 1 million CAUTIs [15] have significant impact on our patients' lives and on the healthcare system, with an average expense of $500–$3,000 per CAUTI.[16] Some of the risk factors for CAUTI are prolonged catheterization greater than six days, female gender, diabetes, catheter inserted outside of the operating room, azotemia, drainage tube below the level of the bladder and above the collection bag, and other active site infections.

All cardiac surgical patients have an indwelling Foley catheter placed as a medical necessity and as part of their operation and immediate postoperative medical management. Hence, constant evaluation of techniques for insertion, maintenance, and early removal after 24-48 hours (if medically not needed) should be required practice. The concept is to decrease device utilization. Other initiatives have included daily assessment for catheterization need, nurse-driven protocols, physician reminders, and guides such as the bladder bundle.[17] Key steps in CAUTI prevention efforts are outlined in Table 3.[18]

• Use indwelling catheters only when medically necessary.
• Use aseptic insertion technique with appropriate hand hygiene and gloves.
• Allow only trained healthcare providers to insert catheter.
• Properly secure catheters after insertion to prevent movement and urethral traction.
• Maintain a sterile closed drainage system.
• Maintain good hygiene at the catheter-urethral interface.
• Maintain unobstructed urine flow.
• Maintain drainage bag below level of bladder at all times.
• Remove catheters when no longer needed.
• Do not change indwelling catheters or urinary drainage bags at arbitrary fixed intervals.
• Document indication for urinary catheter on each day of use.
• Use reminder systems to target opportunities to remove catheter.
• Use external (or condom-style) catheters if appropriate in men.
• Use portable ultrasound bladder scans to detect residual urine amounts.
• Consider alternatives to indwelling urethral catheters, such as intermittent catheterization. Some studies have reported fewer complications with use of a suprapubic catheter, but the surgical procedure required to insert the suprapubic catheter is associated with additional risks. Current evidence is not sufficient to support the routine use of a suprapubic catheter for short-term catheterization to prevent symptomatic urinary infection or other complications..

Table 3. Programs, practices, and interventions that may be implemented in CAUTI prevention efforts. Source: Guide to the elimination of catheter-associated urinary tract infections, APIC, 2008.[18] Reprinted with permission from APIC.

Ventilator-Associated Pneumonia

Ventilator-associated pneumonia (VAP) carries significant mortality (15–50%),[19] increased length of stay, and increased cost ($11,897–$51,517).[20, 21] A significant number of cardiothoracic patients have preexisting lung disease including COPD. Type of surgery, endotracheal intubations, and compromised respiratory function are some of the factors that make these patients more susceptible to VAP. Multisystem organ failure, coma, and oropharyngeal colonization are other risk factors. Establishing diagnosis of VAP and separating it from other pneumonias is important since national benchmarks such as National Healthcare Safety Network (NHSN) definitions can be used. Strategies to reduce VAP should be part of the bigger effort of reducing HAIs. The first step in any of these campaigns is education and awareness. A team approach including the respiratory therapists, nurses, physicians who care for these patients, and an infection preventionist is key. Table 4 includes the recommendations for reducing VAP.

1. Education and awareness of staff about VAP
2. Development and implementation of ventilator bundle: • Head of the bed up (30-45 degrees) • Daily sedation holiday • Perform routine antiseptic mouth care • Ventilator weaning protocols • Avoid routine ventilator changes • Remove condensate from ventilator circuits • Early mobility of selected ventilator patients • Enteric feeding (preferably small bowel) • DVT prophylaxis • Regular surveillance for compliance and outcome measures

Table 4. Recommendations for reducing ventilator-associated pneumonia.

Methodist DeBakey Heart & Vascular Center Experience

Patient safety and excellence in care are paramount goals of the Methodist DeBakey Heart & Vascular Center, and we have been at the forefront of reducing the incidence of HAIs in our cardiac surgical patients. This approach has involved implementing a culture of shared responsibility and accountability and the participation of a multidisciplinary team that includes cardiac surgeons, intensivists, and anesthesiologists, nurses and nurse practitioners, infection preventionists, physician assistants, infectious disease specialists, respiratory therapists, and hospital administrators working together. The team has employed various tools to help induce change, such as increasing HAI education and awareness, implementing best practices and updating them as scientific knowledge changes, providing regular feedback to all stakeholders, working on compliance, and utilizing available technology. Through this process, we realized that the challenge we faced was not just in initiating a campaign; the hard part was sustaining the momentum year after year.

The impact of our efforts — especially some of the best practices such as improved hand hygiene compliance, equipment sterilizations, and room cleaning — have had a ripple effect on all of the HAIs. We didn't try to reinvent every single practice; what worked well in one area was duplicated for use in another. Due to these efforts, over the last few years we have been able to reduce our incidence of CRBSI by 90%, VAP by 90%, and SSI by 70%, and we have lowered our CAUTI rate down to 0.2%, resulting in millions of dollars in cost savings and many lives saved. Perseverance is key, and in our case it has paid off.

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