

Infections in Compromised Patients

139

Inadequate Toilet Cleaning May Lead to Infections with Extended Spectrum β -Lactamase (ESBL) Producing Bacteria in Patients on an Hematological Intensive Care Unit

Jan van Zeijl, MD, PhD.¹, Tiny T. Jilesen-Hofstra², Peter Joosten³, Gerda T. Noordhoek¹.

¹Public Health Laboratory Friesland, Leeuwarden, The Netherlands, ²Medical Center Leeuwarden, Leeuwarden, The Netherlands, ³Medical Center Leeuwarden, Leeuwarden, The Netherlands.

Background

At SHEA 2006 we presented an outbreak with extended spectrum β -lactamase (ESBL) producing *Escherichia coli* on an hematological intensive care unit (HICU) as a result of persistent colonization of a toilet in the bathroom of an HICU room. Our case showed that additional hygienic measures are of the highest importance in order to prevent the spread of these strains to the hospital environment.

Objective

Since this outbreak, several interventions were undertaken. Here we describe intermittent colonization and infection with antibiotic-resistant Gram-negative bacteria, including ESBL producing strains, in patients on an HICU ward, due to colonization of HICU toilets.

Methods

Patients with leukemia who are neutropenic during chemotherapy are admitted in separate positive pressure HEPA-filtered isolation rooms and receive selective bowel decontamination (SBD) with ciprofloxacin and fluconazole to prevent infections with Gram-negative bacteria and yeasts. During SBD, surveillance cultures (from throat, feces and urine) are taken twice weekly. Piperacillin/tazobactam is used as empirical treatment for neutropenic fever. Comparison of isolated ESBL producing *E. coli* strains was performed by random PCR with ERIC and REP primers. DNA fingerprints were analyzed with GelComparII.

Results:

After the 2004-2005 outbreak the frequency of cleaning and decalcification of the toilets was intensified and samples of the toilets were obtained at monthly intervals. At first this intervention seemed to have resulted in definitive elimination of the strain. However, after three months the same ESBL-strain reappeared in the toilet. Then, it was decided to replace the toilets in all HICU rooms by toilets with a stronger glaze layer. Fittings between the water reservoirs and the toilets were also repaired or replaced. The next 8 months samples were negative until a ciprofloxacin resistant *E. coli* appeared in surveillance cultures (feces and urine) of one patient, as well as in the toilet of that patient's bathroom. This toilet also contained a ciprofloxacin resistant *Aeromonas species* and an ESBL-producing *Citrobacter freundii* that produced an inducible β -lactamase as well. Simultaneously obtained samples from the toilet of another HICU room demonstrated a ciprofloxacin resistant *Pseudomonas aeruginosa*. It appeared that for esthetic reasons cleaning personnel had changed the toilet brushes for non-fitting, unpractical brushes, which resulted in inadequate cleaning.

Conclusions:

Infection prevention is of major importance for neutropenic patients. Apart from minimizing the risk of infection with endogenous flora, prevention of infection from exogenous sites is necessary. We demonstrate that small changes in the environment of the patient may have great consequences and may be life-threatening.

Bloodstream Infections among Heart Transplant Recipients

Carla M. Guerra, Henrique L. Godoy, Luci Correa, Carlos A. P. Pereira, Antonio C. Carvalho, Dirceu R. Almeida.
UNIFESP, sao paulo, Brazil.

Background

Bloodstream infections (BSI) are a well recognized problem after solid organ transplantation and they have been associated with loss of graft and increased mortality. BSI affects 22.4 - 49.0% of liver transplant recipients and 3.5-76.7% of kidney recipients, but information in heart transplant (HT) recipients is particularly limited.

Objective

To describe the incidence, clinical characteristics, and outcomes of BSI in HT recipients.

Methods

A retrospective cohort study was conducted in a 680-bed tertiary teaching hospital, from November 1986 through June 2005. All patients underwent heart transplantation who survived more than 7 days after transplantation procedure were included in the study. Blood samples for culture were obtained by standard procedures. Until January 1995, blood cultures were processed by a manual system. From that date to the end of the study, an automated blood culture system (BACTEC 9240®) was introduced. The Centers for Disease Control and Prevention criteria were used as standard definitions for nosocomial infections.

Results

One hundred thirty six HT were performed in the study period. Thirty-one episodes of BSI were diagnosed in 20 out of 136 HT recipients (14.7%), 91.1% of them after January 1995. Forty-three percent of BSI occurred in the first month post transplantation, 25.7% during month 2-6, and 31.2% more than 6 months after transplantation. The most frequent sources of BSI were: primary (32.0%), surgical site infection (29%), and lower respiratory tract (21.0%). Gram-positive organisms predominated (56.3%) over Gram-negative rods (34.3%) and fungi (9.3%). The most common microorganisms were methicillin-resistant *S. aureus* (38.7%) and carbapenem-susceptible *A. baumannii* (19.3%). Eighteen episodes of BSI were hospital-acquired (56.0%). The mortality among patients with BSI was 15.6%, 80.0% of these deaths were associated with hospital-acquired episodes.

Conclusion

BSI remain a significant problem in heart transplant recipients and by far the most frequent infectious complication after heart transplantation. In our study, most of those were hospital-acquired and related to surgical site infection or were primary bloodstream infection. Stricter measures to prevent and control health care related infections are amenable goals that may further reduce BSI in this population.

Infection Control Experience in a Transplant Cooperative Care Center Over a 6.5 Year Period

Ahmad R. Nusair, M.D.¹, Dawn Jourdan, R.N.², Sharon Medcalf, R.N.², Nedra Marion, R.N.², Peter Iwen, Ph.D.¹, Mark E. Rupp, M.D.¹.

¹University of Nebraska Medical Center, Omaha, NE, USA, ²The Nebraska Medical Center, Omaha, NE, USA.

Background

The Cooperative Care Program (CCP) is an innovative way to deliver care to solid organ (SOT) and hematopoietic stem cell (HSCT) transplant patients in which a patient and caregiver (spouse

or family member) are housed in a comfortable, home-like setting. However, the CCP poses unique infection control issues as these patients are at high risk of nosocomial infection.

Objective

To characterize the types and rates of nosocomial infection in the CCP, evaluate environmental contamination, and ascertain patient/care partner colonization or infection with MRSA or VRE.

Methods

1) CDC-NNIS definitions and procedures were implemented to prospectively ascertain infection rates. 2) Patient and care partner living areas and treatment center rooms were surveyed for environmental contamination due to MRSA, VRE, or *Clostridium difficile* prior to opening the CCP and after eight months of operation. 3) Adult patients and their care partners, who granted informed consent, underwent nares and rectal cultures for MRSA and VRE at the time of admission and discharge.

Results

1) From June 1999 through December 2005, 991 patients were admitted to the CCP resulting in a total of 19,365 patient days (14106 for HSCT, 5259 for SOT). The most common nosocomial infection was blood stream infection (5.74 and 4.94 per 1000 pt d for HSCT and SOT respectively). Table 1 documents the rates (infection/1000 pt d) of the most frequently observed infections in the CCP. 2) There was no evidence of environmental contamination with MRSA, VRE, or *C. difficile* before or 8 months after initiating the CCP. Air sampling revealed a heavy localized burden of *Aspergillus* prior to opening the CCP, which prompted fungal abatement. No cases of invasive aspergillosis were observed in CCP patients. 3) 45 patients and 39 care partners consented to active surveillance cultures. Acquisition of MRSA in the CCP was not observed. However, 3 of 45 (6.7%) and 6/21 (28.6%) of patients were colonized with VRE at admission and discharge. Molecular typing of VRE isolates by PFGE revealed polyclonal banding patterns. The rate of infection due to MRSA and VRE in the CCP was 0.15 and 0.26 per 1000 pt d respectively.

	HSCT	HSCT	SOT	SOT
Type of Infection	No.	Rate	No.	Rate
BSI	81	5.74	26	4.94
CDAD	56	3.97	3	0.57
SSI	0	0	9	1.17
UTI	2	0.14	4	0.76
Pneumonia	9	0.64	1	0.19
Other	21	1.49	8	1.52

Conclusions

- 1) In the CCP there is a small, but significant risk of developing a nosocomial infection or being colonized with an antibiotic-resistant pathogen. The most commonly observed infection was blood stream infection. *C. difficile* colitis occurred in HSCT patients at a higher rate than SOT patients. 2) A construction flaw promoted environmental *Aspergillus*, which was revealed by air sampling and was abated prior to patient occupation. 3) Limited active surveillance cultures in the CCP revealed some acquisition of multi-drug resistant organisms, but infection rates due to MRSA or VRE were low.

Khatuna Kadeshvili, MD, Kent A. Sepkowitz, MD.
MSKCC, NY, NY, USA.

Background

Early recognition of parainfluenza virus (PIV) infection prompts implementation of isolation precautions to prevent transmission. The clinical syndrome of PIV however is not well-characterized. We therefore reviewed our experience over the past 2 years with this infection

Objective

To determine whether a typical clinical presentation of PIV in cancer patients could be defined that would allow earlier isolation of patients with the disease.

Methods

Retrospective review of all patients with microbiologically determined PIV at MSKCC from January 2004 and December 2005

Results

73 cases of PIV were diagnosed from among 3660 respiratory specimens (nasopharyngeal swab, bronchial wash/lavage, sputum) submitted in 2004-5. During the same 2-year period, 121 cases of influenza and 96 cases of RSV were diagnosed. No instances of secondary transmission of PIV were identified. For the 73 cases of PIV, 55 (75%) incident specimens were positive on both DFA and culture; 14 (19%) on culture alone; and 5 (6%) on DFA alone. The PIV strain type varied: 21 patients had type 1; nine had type 2 and 43 were diagnosed with type 3. The most commonly reported symptoms were cough (49 patients or 86%) and rhinorrhea (33 or 82%) and fever (43 or 62%). Lung infiltrate was present in 24 (39%) of the 61 patients who received radiologic evaluation. Two patients with PIV died of respiratory failure

Conclusions

PIV has a very non-specific presentation in patients with cancer. DFA is an effective method to identify most cases. Lung involvement evident on radiographic exam occurs frequently; presence of infiltrate therefore does not exclude the diagnosis. Rapid identification and isolation of patients with PIV is necessary to prevent secondary transmission

143

Health Care-related Infections in Solid-organ Transplants Recipients

Angela F. Sola, Carla M. Guerra, Henrique L. Godoy, Ana Rita C. Bittencourt, Luci Correa, Eduardo A. S. Medeiros.
UNIFESP, sao paulo, Brazil.

Background

Solid-organ transplantation became, in the last few decades, an uncontested therapeutic option to several terminal illnesses. Despite advances in immunity suppression modulation, prophylaxis, and early diagnosis of infections, incidence related to infectious complications still remains high. The health care-related infection (HCRI) appears as regular complications in severity ill patients, facilitated by the use of invasive procedures, associated diseases and immunity suppression treatment. In addition to potentially increasing mortality rate, these infections raise the cost of treatment and extend the length of hospital stay.

Objective

To access the incidence of HCRI, most prevalent etiologic agents, and their impact in patient outcome.

Methods

Retrospective cohort study was conducted in a tertiary teaching hospital, between January 2004 and March 2005. All patients underwent solid-organ transplant whom infections occurred between the surgical procedure and the first month post-transplantation were included.

Results

Eighty-one solid-organ transplants were performed in the study period, 35 double kidney and pancreas transplants (43.2%), 20 heart transplants (24.7%), 17 liver transplants (21.0%), and 9 kidney transplants (11.1%). The incidence of HCRI was 42.0%. Fifteen percent of the cases were surgical site infections, 14.0% pneumonias, 9.0% primary bloodstream infections, 4.0% urinary tract infections, and 2.0% skin infections. Frequency of different infections in solid organ transplants is shown in Table 1. Most prevalent etiologic agents were *K. pneumoniae* (8.6%), *P. aeruginosa* (7.4%); *A. baumannii* (5.0%) e *S. aureus* (2.5%). The mortality rate during the first month transplantation period was 18.0%, none of deaths was due to infection.

Table 1: Frequency of different infections in solid organ transplants

	Heart N=20	Kidney N=9	Double kidney and Pancreas N=35	Liver N=17
Surgical Site Infection	4 (20%)	0	7 (20%)	1 (6%)
Pneumonia	3 (15%)	0	1 (3%)	7 (41%)
Urinary Tract Infection	0	1 (11%)	2 (6%)	0
Primary Bloodstream Infection	1 (5%)	0	1 (3%)	5 (29%)
Skin	1 (5%)	0	0	0
Total	9 (45%)	1 (11%)	11 (31%)	13(76%)

Conclusion

Several factors interfere on the incidence of surgical site infections in solid-organ transplant: ASA index, the potential contamination of the surgical incision, and the length of surgery. The high rate of infection found in this study suggests a demand for stricter prevention measures and control of health care-related infections in the institution, mostly during the perioperative period, since a high occurrence of surgical site infection was observed. Better detailed epidemiological studies are essential for planning health care-related infections surveillance actions and prognosis of solid-organ transplant submitted patients.

144

From the Bench to the Bedside: The Role of Infection Control during Hematopoietic Stem Cell Transplantation (HSCT)

Charlene M. Carriker, BSN RN ICP, Jay B. Varkey, MD, Mary A. Oden, RN, MHS-CL, Wayne R. Thomann, PhD, Keith S. Kaye, MD, MPH.
Duke University Health System, Durham, NC, USA.

Background

Advances in HSCT have resulted in markedly improved outcomes among patients with severe immune dysfunction. Infections occurring as a direct complication of HSCT are infrequent and risk factors are poorly understood.

Objective

To identify IC risk factors for post-transplant infections among HSCT recipients.

Methods

Prior to HSCT, a research laboratory depletes the harvested marrow of T cells in a complex multi-step process that requires agglutination with soybean lectin, followed by two cycles of rosetting with sheep erythrocytes treated with aminoethylisothiuronium bromide. To ensure that the prepared stem cells administered to the patient are sterile, a sample of the final infusate fraction is routinely cultured at the time of transplantation. From 1982 to June 2006, 265 patients underwent HSCT; only 6 (2.26%) of these patients had infusate fraction sterility tests that grew positive cultures. From June 2006 to November 2006, 8 patients underwent HSCT; 4 (50%) of these patients had infusate fraction sterility tests that grew positive cultures. Two of the fractions grew out *Chryseobacterium* species, 1 grew out *Klebsiella pneumoniae*, and 1 grew out a yeast

as well as diphtheroids. One patient developed a bloodstream infection with *Chryseobacterium* following transplantation. All patients were empirically treated for infection and did well clinically. An IC investigation was conducted to review the process of preparing stem cells and to identify potential causes of contamination.

Results

The IC investigation identified several factors that may have caused contamination of the final fraction. First, the research laboratory preparing the stem cell fraction had recently changed vendors that supplied the Alsever's solution used to preserve sheep erythrocytes. Second, a new irradiator had recently been used to sterilize the final fraction. Further investigation demonstrated that the new irradiator was delivering a suboptimal radiation absorbed dose (RAD). Investigation of the research laboratory that prepared the stem cell fractions also identified several practices that were not optimal with regards to IC guidelines and could be considered potential hazards: inadequate disinfection of equipment, inconsistent use of a laminar flow hood, and inconsistent use of personal protective equipment among lab personnel. All IC recommendations were implemented and the irradiator was calibrated to deliver the appropriate RADs.

Conclusions

A recent IC investigation identified issues that may have contributed to contamination of the stem cell infusate that is delivered to patients at the time of HSCT. Despite marked advances in medical research and technology to treat serious diseases, it is essential that optimal IC practices are implemented to maximize patient safety. Consistent multi-disciplinary communication among clinicians, IC and engineering personnel is vital.

145

An Evaluation of a Surveillance System for Detecting Invasive Aspergillosis among Transplant Recipients

Douglas C. Chang¹, Lauren A. Burwell¹, G. Marshall Lyon², Gwen Abdulhafid², Scott K. Fridkin¹.
¹Centers for Disease Control and Prevention, Atlanta, GA, USA, ²Emory University School of Medicine, Atlanta, GA, USA.

Background:

Invasive aspergillosis (IA) is an important cause of morbidity and mortality among recipients of hematopoietic stem cell transplants (HSCT) and solid organ transplants (SOT). Recently, the Transplant Associated Infection Surveillance Network (TransNet), a large U.S. multi-center cooperative, conducted surveillance of proven and probable invasive fungal infections as defined by the European Organization for Research and Treatment of Cancer and the Mycoses Study Group (EORTC/MSG). Since proven or probable definitions require microbiologic or pathologic evidence, some clinically relevant IA infections that do not meet proven or probable criteria may meet the EORTC/MSG definition for possible IA.

Objective:

We sought to determine the sensitivity of reporting proven/probable IA to TransNet. We also sought to determine the frequency of possible IA at one TransNet site and to evaluate how many of these possible IA were clinically relevant.

Methods

Patients enrolled in TransNet from Hospital A received organs (HSCT and SOT including heart, liver, lung, kidney, and pancreas) from April 2001 through September 2005. Suspected cases of IA were defined as patients enrolled in TransNet who had at least one hospital visit during April 2001 to January 2006 discharged with ICD-9 codes suggestive of IA. Suspected cases were subsequently classified using EORTC/MSG definitions for proven, probable, and possible infections by chart review. Sensitivity was calculated as proven/probable IA cases reported to TransNet, divided by all proven/probable IA cases.

Results

Of 1736 patients receiving SOT or HSCT followed by TransNet surveillance at Hospital A, 86 patients were suspected case-patients identified with codes consistent with IA; most (57) were coded as "other and unspecified mycoses" (117.9). Of the 86 suspected case-patients, only 36 (42%) met definitions for proven/probable (16; 19%) or possible (20; 23%). Of the 16 proven/probable IA cases identified with ICD-9 codes, 14 were reported to TransNet, but 2 were not reported to TransNet. An additional 3 proven/probable cases were reported to TransNet that were not identified by ICD-9 codes. The sensitivity of TransNet for identifying proven/probable IA was 89% (17/19). Of the 20 possible IA cases, 19 (95%) lacked microbiologic or pathologic evidence of IA, but all received antifungal therapy and 4 (20%) had CT scan signs favoring IA over another etiology in patients with prolonged neutropenia after HSCT.

Conclusions

At Hospital A, sensitivity for reporting proven/probable IA cases to TransNet was high. The number of possible IA cases was at least equal to the number of proven/probable IA cases. Since many possible IA cases were clinically relevant but lacked microbiologic or pathologic evidence, inclusion of such cases should be considered when determining estimates of IA disease burden among transplant recipients.

146

Control of an Outbreak of Parainfluenza Virus on a Hematologic Malignancy Service
Praseeda Sridhaaran, MD¹, Richard Maziarz, MD¹, Mary Post, RN¹, Dean Erdman², Teresa Peret², **Randy A. Taplitz**¹.

¹Oregon Health and Science University, Portland, OR, USA, ²center for disease control and prevention, Atlanta, GA, USA.

Background

Parainfluenza virus (PIV) infection can cause significant morbidity and mortality in stem cell transplant recipients. There are no standard guidelines on prevention and control of PIV in the outpatient setting. We describe here an outbreak of 13 cases of PIV among Hematologic Malignancy Service (HMS) patients over a three-month period.

Objective

To describe the epidemiology of a PIV outbreak and our interventions

Methods

After two HMS inpatients diagnosed with PIV-3 were noted to have multiple recent HMS outpatient clinic (OPC) visits, an investigation of respiratory illness policy and procedures in the HMS OPC was undertaken. Patient charts were reviewed for the presence of respiratory signs or symptoms (RSS). Staff was questioned about recent RSS, and strict adherence to ill-provider policy was enforced. Scripts and signs for phone and clinic triage were created. Patients and family members were asked to wash hands and were screened for RSS on entry to the OPC. Visitation of symptomatic family members was limited. Symptomatic patients were immediately masked and placed in a private room with contact and droplet precautions, and a respiratory viral culture was obtained. HMS inpatients with respiratory illness were isolated and cultures obtained. All PIV isolates obtained during the outbreak period were sent for molecular typing. Patients with PIV-3 were asked to adhere to strict hand hygiene and wear a mask for one month after active infection during all OPC visits

Results

Between June 21 and Aug 30, 13 HMS patients were diagnosed with PIV-3 infection, with 9 patients hospitalized and 3 deaths. Molecular typing of the HA gene of the 11 available isolates revealed that 10 isolates fell into two genetically related clusters; each of these clusters appeared to be closely linked in terms of time and place of acquisition. The 11th isolate was unrelated to the two clusters. The major infection control (IC) interventions were introduced between August 20th and August 24th. An epidemic curve excluding the unrelated case revealed that PIV infection

frequency peaked between August 17 and August 26th. There were no cases attributed to this cluster after Aug 30th. Interviews did not identify symptomatic staff during the outbreak. It was noted that prior to the intervention period, several unmasked symptomatic patients and family members had been cared for in the open care area of the HMS OPC.

Conclusions

13 patients with PIV-3 virus infection associated with significant morbidity were identified in a 3-month period in the HMS. Based on genetic relatedness as well as demographic and exposure history, acquisition of PIV in a majority of these cases likely took place in the HMS OPC. Prompt attention and focus on IC interventions was associated with a rapid decrease in the number of incident cases. Policies and procedures on approach to patients with respiratory viral illnesses in HMS OPC populations should be formulated with clinic staff.

147

A University HealthSystem Consortium (UHC) Quality Performance Benchmarking Study of the Insertion and Care of Central Venous Catheters

Brian P. Harting, MD¹, Thomas R. Talbot, MD, MPH², Joan Hebden, RN, MS, CIC³, Joanne Cuny, RN, MBA⁴, Timothy H. Delitt, MD⁵, William H. Greene, MD⁶, John Segreti, MD¹.

¹Rush University Medical Center, Chicago, IL, USA, ²Vanderbilt University School of Medicine, Nashville, TN, USA, ³University of Maryland Medical Center, Baltimore, MD, USA, ⁴University HealthSystem Consortium, Oak Brook, IL, USA, ⁵Harborview Medical Center, Seattle, WA, USA, ⁶Stony Brook University Medical Center, Stony Brook, NY, USA.

Background

The University HealthSystems Consortium (UHC) is a group of heterogeneous University Medical Centers participating in studies focused on improving hospital performance by studying quality measures. Bloodstream infections (BSI) related to central venous catheter (CVC) insertion lead to increased morbidity, inpatient mortality, cost and increased length of stay. Healthcare providers who follow a “best practice” policy for central venous catheter insertion should expect improvements in rates of catheter-related bloodstream infections (CR-BSI) and associated complications.

Objective

We report the experiences of 19 UHC hospitals participating in a quality performance benchmarking study to improve central venous catheter insertion and care.

Methods

We conducted a retrospective review of performance measures and selected outcomes of patients admitted to UHC hospitals who underwent CVC insertion. Co-morbid conditions and bloodstream infection risk factors were evaluated but not matched between participating hospitals. Operational characteristics regarding institutional policies and practices were also surveyed. Performance measures included: 1) percentage of CVC placed in subclavian vein; documentation of the following: 2) maximal barrier precaution use; 3) chlorhexidine skin preparation; 4) daily dressing assessment; 5) daily assessment of medical necessity to continue CVC use; 6) mandated use of a “best practice policy;” and 7) use of a CVC insertion checklist. We evaluated incidence of CR-BSI.

Results

Seven hundred nineteen patients were included in the study constituting the insertion of 1032 central venous catheters and evaluation of 7,781 CVC line days. Wide variation existed between and within institutions. All hospitals struggled to provide evidence of performance of maximal barrier precautions for CVC insertion (mean 1.2% of all CVCs inserted, range 0.0-8.2%). Documentation of performance of components within the maximal barrier precaution guidelines included: hand washing (mean 3.9%, range 0.0-39%); use of cap and mask (mean 2.1%, range 0.0-13.6%); use of sterile gloves and gown (mean 7.9%, range 0.0-39%); and use of full body

drape (mean 7.7%, range 0.0-46.3%). Hospitals varied in percentage of CVC placed in the subclavian vein, use of chlorhexidine skin preparation prior to insertion, and daily assessment of medical necessity to continue CVC. The majority of hospitals inspected CVC dressings daily at an adherence rate of 97% or higher. CR-BSI was diagnosed in 55 patients (7.07 infections per 1000 central line days).

Conclusions

A heterogeneous group of university hospitals demonstrated a real need for improvement in implementation and documentation of a majority of quality performance measures related to CVC insertion.

148

The Use of Healthcare-acquired Urinary Tract Infection (UTI) Prevention Practices by U.S. Hospitals: A National Mixed-methods Study

Sanjay Saint, MD, MPH¹, Timothy Hofer, MD, MSc¹, Christine Kowalski, MPH², Russell Olmsted, MPH, CIC³, Carol A. Kauffman, MD¹, Jane Forman, ScD¹, Laura Damschroder, MPH¹, Samuel Kaufman, MA¹, Jane Banaszak-Holl, PhD⁴, Sarah Krein, PhD, RN¹.

¹Ann Arbor VA Medical Center and University of Michigan, Ann Arbor, MI, USA, ²Ann Arbor VA Medical Center, Ann Arbor, MI, USA, ³Saint Joseph Mercy Hospital, Ann Arbor, MI, USA,

⁴University of Michigan School of Public Health, Ann Arbor, MI, USA.

Background

Though UTI is the most common nosocomial infection, no national data exist describing what U.S. hospitals are doing to prevent this frequent problem.

Objective

We conducted a national mixed-methods study, employing both quantitative and qualitative evaluation, to: (1) describe the current practices used by hospitals to prevent nosocomial UTI; (2) elucidate facilitators of, and barriers to, the adoption of various practices; and (3) assess the effects of centralization (exemplified by Veterans Affairs [VA] facilities) on the adoption of such practices.

Methods

The quantitative phase entailed mailing written surveys to infection control coordinators at a national random sample of non-federal U.S. hospitals with an intensive care unit and more than 50 hospital beds (n = 600) and all VA hospitals (n = 119). The survey asked about practices to prevent nosocomial UTI and other device-associated infections. Analyses were weighted to be nationally representative. The qualitative phase consisted of semi-structured phone interviews with key personnel and site visits to several of the hospitals in order to identify factors that either facilitated or prevented the use of various practices.

Results

The survey response rate was 72%. Overall, 56% of hospitals did not have a system for monitoring which patients had urinary catheters placed, and 74% did not monitor catheter duration. Thirty percent of hospitals regularly used antimicrobial urinary catheters and portable bladder scanners; 14% regularly used condom catheters in men; and 9% regularly used catheter reminders. VA hospitals were significantly more likely than non-VA hospitals to use portable bladder scanners (49% vs. 29%, p < .001) and condom catheters in men (46% vs. 12%, p < .001); non-VA hospitals were significantly more likely to use antimicrobial urinary catheters (30% vs. 14%, p < .01). In multivariable analysis, hospitals reporting regular use of antimicrobial *central venous* catheters were significantly more likely to report using antimicrobial *urinary* catheters (OR = 3.0; 95% CI: 1.7 - 5.4). From our qualitative evaluation, factors facilitating the use of infection prevention practices included (1) participation in an infection prevention collaborative, and (2) practicing in a hospital environment conducive to change coupled with a champion (who need not be a physician). Barriers included cost silos and the presence of organizational “constipators”

(mid- to high-level managers who are resistant to change).

Conclusions

The prevention practices studied here were used regularly by only a minority of hospitals. Despite evidence of benefit, urinary catheter reminders are used in less than 10% of U.S. hospitals. Infection prevention collaboratives appear to be one promising strategy for encouraging the use of infection prevention practices.

149

Central Venous Catheter-Related Bloodstream Infections in Hospitalized Medicare Fee-For-Service Patients

Leonard A. Mermel, DO, ScM¹, Mark Metersky, MD², Chesley Richards, MD, MPH³, Jeffrey Rothschild, MD, MPH⁴, Harold Kaplan, MD⁵, Yun Wang, Ph.D⁶, Nancy Verzier, MSN, RN, CPHQ⁷, David Hunt, MD⁸.

¹Rhode Island Hospital, Providence, RI, USA, ²University of Connecticut School of Medicine, Farmington, CT, USA, ³CDC/NCID/Division of Healthcare Quality Promotion, Atlanta, GA, USA, ⁴Brigham & Womens Hospital, Boston, MA, USA, ⁵New York Presbyterian Hospital, New York, NY, USA, ⁶Qualidigm, Middletown, CT, USA, ⁷Qualidigm, Middletown, DC, USA, ⁸Centers for Medicare & Medicaid Services, Rockville, MD, USA.

Background

Central venous catheters are commonly used in hospitalized patients. We set out to determine the incidence of catheter-related bloodstream infection (CRBSI) in the hospitalized Medicare population.

Methods

The CRBSI sample was drawn from the Medicare Patient Safety Monitoring System (MPSMS) database that contains 91,688 randomly selected nationwide Medicare fee-for-service (FFS) inpatient medical records from 2002 to 2004. Patients were included for this analysis if they did not have an infection on admission, and their central venous, pulmonary artery or peripherally-inserted central venous catheters were *in situ* for ≥ 48 hours prior to blood cultures being drawn. CRBSI was defined as a patient having a positive blood culture for specific pathogens as determined by expert physician reviewers, and no other sources of infection. If the culture was positive for coagulase-negative staph, at least 2 blood cultures had to be positive to meet study criteria. Multivariate analysis and Hierarchical generalized linear models (HGLM) were developed to assess the association of particular patient characteristics with adverse events and the relationship between specific patient outcomes and adverse events.

Results

138 (1.8%) of the 7751 patients with the above-noted catheters and who met our inclusion criteria developed a CRBSI. The most common pathogens were coagulase-negative staph (46%), enterococci (15%), *S. aureus* (13%) and *Candida* (7%). After HGLM, patients with CRBSI were less likely to be female (OR 0.6, 95% CI 0.4-0.9) and more likely to have CHF (OR 1.6, 95% CI 1.2-2.3). Risk-adjusted in-hospital mortality was higher in catheterized patients with CRBSI (OR 1.8, 95% CI 1.2-2.6) and may be greater in patients with *S. aureus* or *Candida* CRBSI compared with CRBSI due to other pathogens (OR 2.2, 95% CI 1.0-4.6). The adjusted length of hospital stay (LOS) was twice as long in patients with CRBSI (22.7 d) compared to those without CRBSI (11.0 d, $p < 0.001$). Approximately 16,500 hospitalized Medicare patients are estimated to develop a CRBSI annually.

Conclusions

Hospitalized FFS Medicare patients who require central venous catheters are at risk for serious infectious complications. CRBSI is associated with increased in-hospital mortality and LOS in this patient population. Continued efforts should be put forth to further reduce the risk of CRBSI in Medicare patients.

A Four-Year Experience with a Catheter-Associated Bloodstream Infection (CA-BSI) Prevention Program in Intensive Care Units (ICUs)

Anne Caston-Gaa, RN, MSN, MPH, Patricia Rosenbaum, RN, CIC, K. Alexander Shangraw, MPH, Xiaoyan Song, MD, MS, Lisa L. Maragakis, MD, Trish M. Perl, MD, MSc.
The Johns Hopkins Hospital, Baltimore, MD, USA.

Background:

CA-BSIs in ICUs are associated with morbidity, mortality and cost. In 2002, The Johns Hopkins Hospital, a 926-bed tertiary care center, implemented an intervention to eliminate CA-BSIs in ICUs. All healthcare workers involved in central line placement underwent training in best practices for insertion and maintenance of central venous catheters: hand hygiene, chlorhexidine skin prep, avoidance of femoral lines, full barrier draping and appropriate line care. Checklists for central line insertions and feedback of CA-BSI rates were implemented in all units.

Objective:

To assess the long-term impact of implementing a best practice intervention for decreasing CA-BSIs in ICUs.

Methods:

Infection control practitioners identified CA-BSIs prospectively in 7 ICUs using NNIS definitions. CA-BSIs rates were calculated using NNIS standardized methodology. Rates in 2002 were compared to the pooled mean of rates in 03, 04, 05, 06, and the percent increase or decrease was calculated.

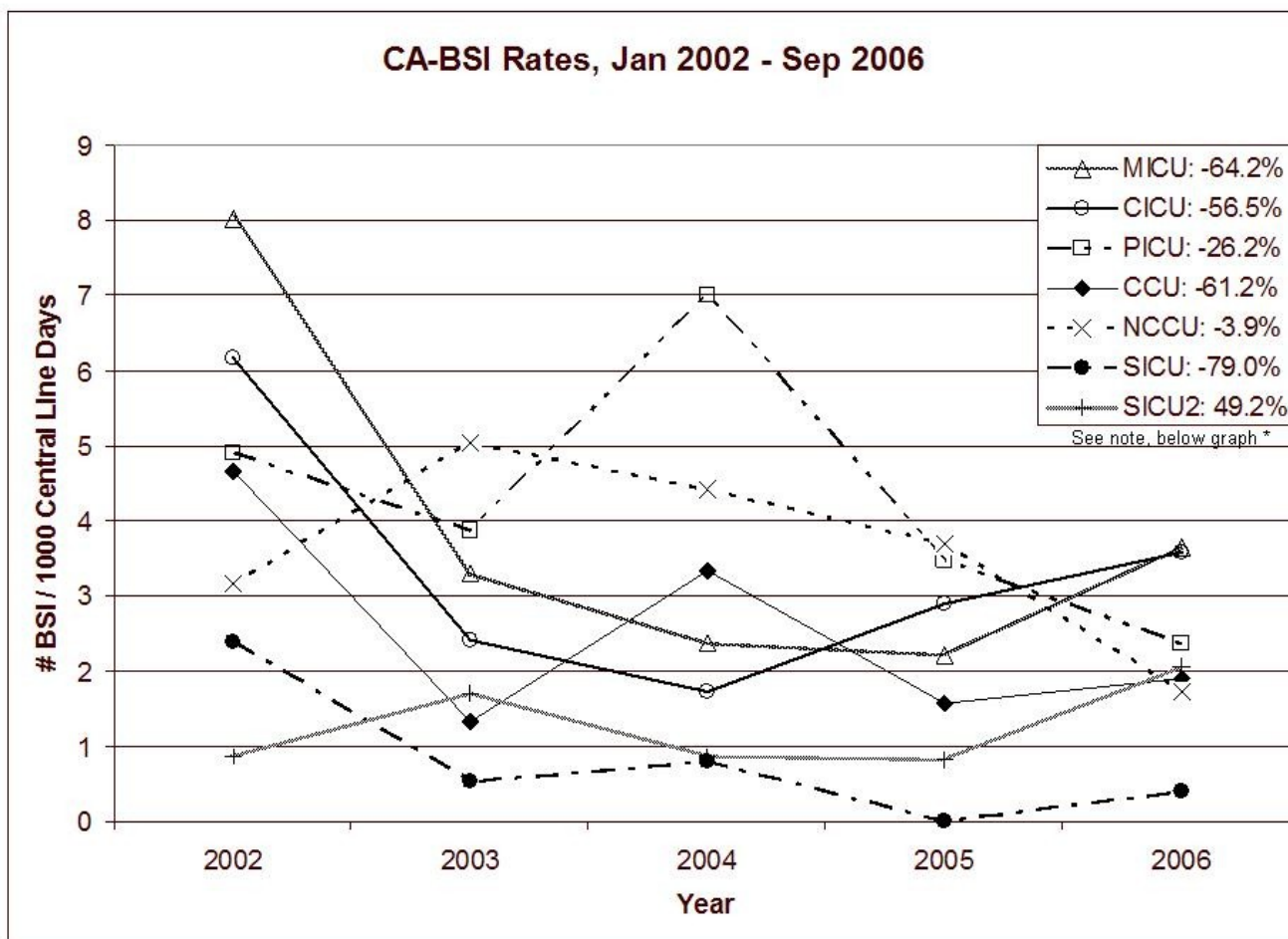
Results

CA-BSI rates from 2002-2006 decreased over the 4-year period (Figure 1). Rates in the surgical ICU (SICU), medical ICU (MICU) and coronary care unit (CCU) decreased most dramatically. Both SICUs had no CA-BSIs for more than 1 year. The cardiac surgery unit (CICU) had an increase from 1.41 in Q4-05 to 4.94 in Q1-06 that was attributable to not using the checklist during central line placement; re-initiation of the checklist led to a rate of 1.28 in Q2-05. Beginning in 2006, rates in 4/7 ICUs have increased slightly. Identified breaches in practice are currently being addressed.

Conclusions

Despite intermittent increases in CA-BSI rates over time, there has been an overall sustained reduction across the ICUs. Some units have had rates of zero or near zero for an extended time. Increasing CA-BSI rates in 2006 suggest that educational interventions may need to be repeated at certain time intervals due to healthcare worker complacency or staff turn-over. Monitoring rates

and providing feedback to ICUs about rates and adherence to best practice is critical.



152

Increased Catheter-associated Bloodstream Infection Rates After the Introduction of a New Positive Pressure Mechanical Valve Intravenous Access Device

Bharti Asnani, M.D.¹, Elias Abrutyn, M.D.¹, Barbara Fry-Arrighy, B.S., CIC², Angela Paravancini, B.S.², Judith A. O'Donnell, M.D.¹.

¹Drexel University College of Medicine, Philadelphia, PA, USA, ²Hahnemann University Hospital, Philadelphia, PA, USA.

Background

Needle-less connectors used today as basic elements of an infusion system, were developed in the pursuit of augmenting healthcare worker safety, and the ongoing advancement of infusion technology. Lately, positive-pressure mechanical valve (PPMV) intravenous access port (IAP) have been created to keep central venous catheters (CVCs) patent without the use of heparin, by preventing back flow and reducing the clotting of blood in the catheter. There have been recurrent concerns about an increased risk of catheter associated bloodstream infections (CA-BSI) with the use of needle-less connectors, and therefore presenting us with both advantages and disadvantages.

Objective

To evaluate the rate of CA-BSI after the introduction of a PPMV-IAP at a tertiary-care university

teaching hospital.

Methods

Active surveillance for CA-BSI is performed by the Infection Control department as per the Centers for Disease Control and Prevention criteria and National Nosocomial Infection Surveillance definitions. A PPMV-IAP (Alaris Medical Systems) was introduced in our institution in July 2005. Education on proper use of the device was provided to the healthcare personnel prior to introduction, and the intravenous device access policy remained constant during the period of the study. Because of increased CA-BSI, the use of the PPMV device was discontinued in February, 2006, and the previous Mechanical Valve (MV) was reintroduced. Statistical analysis was performed to compare the rate of CA-BSI per 1,000 catheter days before, during and after the use of the PPMV-IAP.

Results

[[Unsupported Character - €]] Comparison of Pre-PPMV with PPMV use

♣ Comparison of PPMV with MV use

Table 1. HOSPITAL WIDE DATA

Time period	Catheter In Use	CA-BSI/ 1,000 Catheter Days	OR (95% CI) p value
January 20 05 - June 2005	MV	7.7	1.74 (1.36-2.23) p≤0.001 [€]
July 2005- February 2006	PPMV	13.4	
March 2006 - August 2006	MV	4.96	0.36 (0.27-0.49) p≤ 0.001*

Table 2. POOLED ICU DATA

Time Period	Catheter In Use	CA-BSI Rate / 1,000 Catheter Days	OR (95% CI) p-value
January 2005 - June 2005	MV	6.45	2.19 (1.47-3.25) p≤0.001 [€]
July 2005 - February 2006	PPMV	14.04	
March 2006 - August 2006	MV	6.41	0.45 (0.30-0.67) p ≤ 0.001*

Conclusions

We report a significant increase in the CA-BSI rates after the introduction of the new PPMV throughout our hospital, and specifically in the ICUs. CA-BSI rates returned to baseline once the PPMV was removed from the institution. Our experience adds further credence to an association between increase CA-BSIs with use of PPMV IAPs.

153

Effect of Enhanced Ultraviolet Germicidal Irradiation in a Heating Ventilation and Air Conditioning System on Nosocomial Infection in a Neonatal Intensive Care Unit

Corinne L. Leach, MD, PhD¹, Gregory A. Wilding, PhD¹, Ralph J. Wynn, MD¹, Bruce A. Holm, PhD², Rita M. Ryan, MD¹.

¹State University of New York at Buffalo, Buffalo, NY, USA, ²State University of New York at Buffalo, Amherst, NY, USA.

Objective

Airborne transmission of nosocomial infection is increasingly reported. Hospital Heating Ventilation and Air Conditioning (HVAC) systems have HEPA filters designed to trap airborne

pathogens. However, HVACs become contaminated and filters are often leaky. We hypothesized that enhanced ultraviolet germicidal irradiation (eUVGI[®]) installed in the HVACs would kill all fly-by and colonizing microorganisms, and decrease the bioload of the NICU environment and patient airways; ventilator-associated pneumonia (VAP) and hospital costs would decrease.

Design

prospective interventional study.

Setting

regional perinatal center Neonatal Intensive Care Unit (NICU), 2001-2003.

Patients

All infants who were intubated at pre-determined times of sampling were studied for colonization. Infants who were <30 weeks gestation and ventilated for ≥ 14 days were studied for VAP.

Interventions

eUVGI was installed in the NICUs remote HVACs.

Measurements and Main Results

The HVACs and NICU environment were cultured at baseline and serially for 10 to 12 months of eUVGI. Tracheal aspirates of intubated patients were also cultured. VAP episodes, antibiotic use, and associated morbidities were compared in high risk patients (*defined as infants who were <30 weeks gestation at birth, requiring ventilation for ≥ 14 days*), who were admitted during the 6-month period prior to eUVGI (Control), with those admitted during 3 consecutive 6-month periods with eUVGI. Time-dependent variables including infection control protocols for hand-washing and cleaning, NICU census, and HVAC filters were unchanged; clinical advances including closed-tracheal suctioning (initiated after study completion) and early extubation (initiated after colonization study period, and excluded in the VAP study by 2 week criteria) were minimized.

Results

Pseudomonas, *Klebsiella*, *Serratia*, *Acinetobacter*, *Staph Aureus* and *CONS* species were cultured from all sites. eUVGI significantly reduced or eradicated HVAC organisms (Baseline 500,000 CFU/cm²; $P=0.015$); NICU environment contamination decreased. ($P<0.0001$) Overall tracheal microbial load decreased 45% ($P=0.004$), and fewer patients became colonized (86% to 56%; $P=0.005$). With eUVGI, the number of high risk patients with VAP decreased (Control: 74%; $n=23/31$ to eUVGI: 39%; $n=7/18$; $P=0.04$), as did VAP frequency per high risk patient (Control: 1.2 to eUVGI: 0.4; $P=0.004$). Lengths of stay and ventilator days were equal for all groups. Antibiotic days decreased with eUVGI: 62% ($P=0.013$), and *Pseudomonas* resistance decreased. Reduced flexible staffing needs yielded net hospital cost reductions of \$13,000 per high-risk patient.

Conclusions

eUVGI eradicates microbes in HVAC systems, and is associated with a decrease in NICU environment pathogens, tracheal colonization, VAP and hospital costs.

154

Improving Patient Area Cleaning/Disinfecting Activities in Twenty Hospitals

Philip C. Carling, MD¹, Michael Parry, M.D.², Peter Kim, MD³, for the Healthcare Environmental Hygiene Study Group.

¹Carney Hospital, Boston, MA, USA, ²Stamford Hospital, Stamford, CT, USA, ³Washington Hospital Center, Washington, DC, USA.

Background

It has become increasingly recognized that microbial contamination of the patient's immediate environment plays a significant role in the transmission of many health-care associated

pathogens. Despite the recommendation that hospitals experiencing increased transmission of MDROs “Monitor (i.e., supervise and inspect) cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and likely to be touched by the patient and health-care professionals” (CDC - 2006; Category 1B), there currently exists no practical means of evaluating and improving the effectiveness of these activities.

Objective

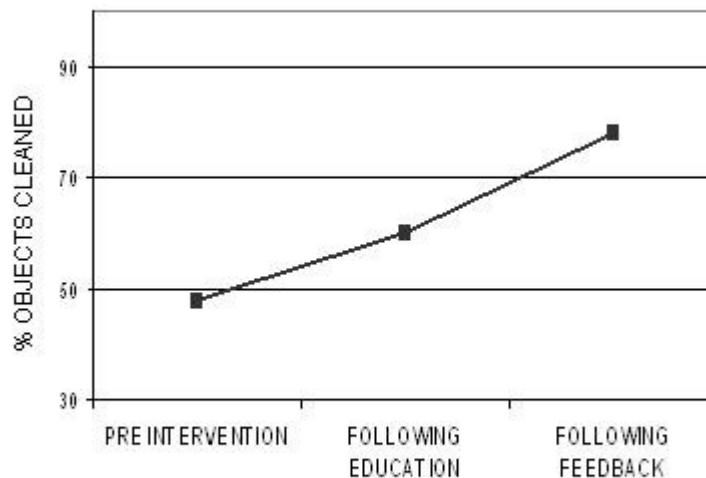
To evaluate the use of an indirect assessment tool to objectively quantify and improve the thoroughness of terminal room cleaning of high touch objects in a range of acute care hospitals.

Methods

An invisible fluorescent targeting method was used to confidentially evaluate the cleaning of 14 standardized high-touch objects. Rooms were marked following terminal cleaning and re-evaluated after one to two patients had occupied the room and it had been again terminally cleaned.

Results

959 rooms and 11,370 objects were evaluated in twenty hospitals ranging in size from 100 to 709 beds. The mean proportion of objects cleaned was 48.4% (95% CI 42.9 to 47.5) prior to educational interventions. While sinks and toilet seats were relatively well cleaned (79.5%), consistently low rates of cleaning were documented for objects at high risk for microbial contamination including bedpan cleaners, toilet area handholds, bathroom and room doorknobs and bathroom light switches (23.3%). Following educational programs and process improvement feedback the cleaning of 264 rooms and 3168 objects were evaluated in the same manner . Overall thoroughness of cleaning improved to 77% (95% CI 78.5% to 89.2%) or 62% from baseline. All hospitals realized significant improvement over pre-intervention results (P = <



.0001).

Conclusion

The use of an objective targeting method in twenty acute care hospitals disclosed substantial opportunities for improving terminal room cleaning/disinfecting activities. Following educational interventions and ongoing performance feedback to the environmental services staff, highly significant enhancement of near-patient environmental cleaning was objectively documented in all hospitals.

