Impact of UV Light Disinfection on CLABSI and CAUTI Rates in a Major Medical Teaching Hospital's MICU

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Abstract

Ultra Violet–C (UV-C) light disinfection was consistently applied to the MICU/CCU from 03/2015 through 07/2015. UV-C light disinfection of the unit was an adjunct to the routine chemical disinfection program already in existence. NHSN SIR metrics were used to measure the impact of UV-C light disinfection. The MICU/CCU experienced a statistically significant reduction in CAUTI incidence and a measurable reduction in CLABSI incidence, although not statistically significant for the 5 month study period that UV-C light disinfection was consistently used. When UV-C light disinfection was withdrawn and delivered as a less vigorous intervention, CAUTI and CLABSI increased, although not statistically significant.

Introduction

Previous authors have established that UV light disinfection has been observed to decrease health care acquired infections (HAIs) in both acute care and long term care facilities[1,2,3]. Specifically, UV light disinfection utilizing UV-C radiation was effective at decreasing the bioburden of MRSA, C. diff, Enterococcus and Acinetobacter in these studies. UV light systems that can deliver UV-C radiation at approximately 254 nm have been documented to eradicate pathogens by denaturing their DNA. UV light systems emitting at this wavelength are capable of breaking down the DNA nucleotide bonds, thus rendering microorganisms incapable of replicating.

Objective

Here we evaluated the efficacy of an automated UV-C triple emitter system, which has been designed to accomplish room disinfection more effectively and in less time. CAUTI and CLABSI rates were evaluated in the MICU/CCU before and after the consistent application of UV-C light disinfection as an Infection Control and Housekeeping intervention. Initially brought on board to JSUMC as a test device through the Crothall Healthcare Products Committee, the UV-C triple emitter matured from a "test and trial" program into a "daily addition" disinfection process in the MICU/CCU. UV-C light disinfection was used in conjunction with the chemical disinfection program deployed by Housekeeping.

Methods

Each discharge room was effectively chemically disinfected, curtain changed, terminally cleaned, and treated with UV-C light. UV-C light was available for use in the MICU/CCU as needed for every discharge during the study period. Protocols for MICU/CCU, Housekeeping, and Bed Management impacting admission and discharge were altered to accommodate this technology. Working collaboratively with MICU/CCU staff regarding these processes, proved to be instrumental in outcomes. The UV-C light disinfection system was consistently applied to the MICU/CCU from 03/2015 through 07/2015 in addition to the housekeeping program already in place. NHSN SIR metrics were used to measure the impact of UV-C light disinfection on CAUTI and CLABSI rates before and after the intervention.

Results

Prior to the study period, the 2014 YTD CAUTI data was unfavorably statistically significant (SIR=1.93, p=0.00, SIR95CI=1.214, 2.933) (Figure 1). During the study period when UV-C light disinfection was consistently used, the MICU experienced a statistically significant reduction in CAUTI incidence (SIR =0.00, p=0.01, SIR95CI =, 0.673) and a measurable reduction in CLABSI incidence (SIR=0.036, p=0.29, SIR95CI = 0.018, 1.763). After the study period when UV-C light disinfection was less consistently applied, CAUTI and CLABSI increased, although not statistically significant (CAUTI SIR=1.44, p=0.41, SIR95CI=0.527, 3.190; CLABSI SIR=1.81, p=0.21, SIR95CI=0.662, 4.004).

Figure 1. 2015 MICU Infection Control Dashboard

Key Terms:

CAUTI = Catheter Associated Urinary Tract Infection
CLABSI = Central Line Associated Blood Stream Infection
NHSN = National Healthcare Safety Network
SIR = Standardized Infection Ratio

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Conclusion

Prior to the new UV-C light disinfection program at Jersey Shore University Medical Center (JSUMC), the Infection Control Committee was striving to reduce the incidence of both CAUTI and CLABSI for over a year. A CAUTI Action Plan had been in place since fourth quarter 2014, secondary to unfavorable year end data (Figure 1). Several nursing improvements to patient care had already been implemented prior to the addition of the triple emitter UV-C system. The addition of the automated UV-C disinfection system further reduced both CAUTI and CLABSI incidence when applied consistently in the MICU.

Environmental contamination of the patient care area is a potential contributing factor to HAI incidence. Several studies demonstrate how the environment of care is integral to preventing transmission of pathogenic organisms[1]. Chemical disinfection has been the gold standard for healthcare, heavily relying on quaternary ammonium and bleach based disinfectant preparations. Previous studies have demonstrated that less than 50% of contaminated surfaces actually make contact with the chemical disinfectant[1]. Establishing a housekeeping program with reliable chemical disinfection efficacy can be challenging. It is speculated that the dedicated UV-C light disinfection program tested in the MICU/CCU was decreasing bioburden for safer delivery of patient care related to CAUTI and CLABSI prevention, more so than just chemical disinfection alone.

References

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