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The Impact of Nursing Staff Adherence with Chlorhexidine Gluconate Bathing on Intensive Care Unit Patient Outcomes

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Dedication

I dedicate this DNP project to my Great-Aunt Glennda Tingle, who has volunteered her time to act as my editor-in-chief. Without your expertise my grades would not be what they are today. To my family, for continually expressing their pride in my achievements and lending a sympathetic ear when things were not going as I had planned. To my friends, who understood how hectic my life would be and stuck by my side even if I couldn't spend as much time with them. Lastly, to my classmates; without the support of others going through the same experience I may have gone mad.

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Abstract

Purpose: The purpose of this study is to evaluate nursing staff adherence to a chlorhexidine gluconate (CHG) bathing protocol in the intensive care unit at Norton Brownsboro Hospital.

Methods: This study utilized a single-site, quasi-experimental, retrospective electronic medical record review format. The sample consisted of 200 patient records post CHG bathing protocol initiation from the Norton Brownsboro Hospital Intensive Care Unit during the period of March, 2015 to May, 2017.

Results: The sample was divided into adherent and non-adherent groups. No significant differences in age, sex, race, ICU length of stay (LOS), BMI, or mortality scores, presence of indwelling medical device, or surgical procedure performed existed between the adherent and non-adherent groups. Adherence was low with only 61 or 30.5% of patients receiving CHG bathing as prescribed. No statistically significant relationship was identified between CHG bathing adherence and patient variables.Only three HAIs were captured in the sample; all were catheter-associated urinary tract infections (CAUTIs) in the adherent group.

Conclusion: Low adherence and lack of statistical significance may indicate a charting discrepancy by ICU nursing staff. It is also reasonable to consider that this study is an actual reflection of the adherence rate. Education, chart audits, and change moles such as Plan-Do-Study-Act (PDSA) should be considered to optimize nursing staff adherence with CHG bathing.

The Impact of Nursing Staff Adherence with Chlorhexidine Gluconate Bathing on Intensive Care Unit Patient Outcomes

Introduction

Healthcare-acquired infections (HAIs) are infections patients acquire while receiving medical care in a healthcare facility which pose a significant risk to patient safety and are often preventable (Centers for Disease Control [CDC], 2016). Of particular interest for the intensive care unit (ICU) population are central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), and surgical site infections (SSI). The ICU population has the highest usage of indwelling devices that contribute to the development of HAIs. Nearly half of all central venous catheter (CVC) usage occurs in the ICU, and upwards of 25% of hospitalized patients experience urinary catheterization, most in the peri-operative and ICU settings (Agency for Healthcare Research and Quality [AHRQ], 2014; Tenke, Koves, & Johansen, 2014). While surgical site infections (SSIs) may not occur in the ICU, the infected patients are 60% more likely to require postoperative ICU care than non-infected patients ("Drexel University Department of Surgery," 2016).

The results of the Healthcare-Acquired Infection Prevalence Survey estimated the 2011 incidence of CLABSI, CAUTI and SSI at 15,600; 35,600; and 66,100 cases (Magill et al., 2014). HAIs increase patients' length of stay, healthcare costs, and mortality. Mortality rates of CLABSI may be as high as 18% with approximately 28,000 deaths annually (Agency for Healthcare Research and Quality [AHRQ], 2014). CAUTI and SSI carry mortality rates between 2-5% with approximately 13,000 deaths occurring as a result of CAUTI, and 75% of deaths in patients with SSIs are caused by the infection ("Drexel University Department of Surgery," 2016; "Urinary tract infection CAUTI and non-CAUTI," 2015). In addition to the lives lost,

HAIs pose a tremendous financial burden to the United States (US) healthcare system. In 2008, the Centers for Medicare and Medicaid Services (CMS) made the decision to stop reimbursing hospitals for the additional costs to care for patients with HAIs while hospitalized (Kennedy, Greene, & Saint, 2013). Therefore, the costs associated with HAIs falls to the responsibility of the healthcare organization. A single incidence of CLABSI costs approximately $45,000 with annual costs to the United States (US) healthcare system of greater than $1 billion, while CAUTIs and SSIs cost the US healthcare system $340-$370 million annually (Anderson & Sexton, 2015; Roser, Piercy, & Altpeter, 2014; Waknine, 2013). Should the causative organism of an SSI be antibiotic resistant, costs can soar to as much as $60,000 per case (Anderson & Sexton, 2015; Roser, Piercy, & Altpeter, 2014).

Background

Supporting Evidence

CHG is a broad spectrum topical antiseptic with activity against gram positive and gram negative bacteria, anaerobes, aerobes, and yeast; it is bacteriostatic or bactericidal depending on the dosage ("Drugs.com", 2017). Ample evidence exists backing the use of daily whole body bathing with chlorhexidine gluconate (CHG) as a means to decrease the rates of CLABSI, healthcare-acquired infections (HAI), and colonization with multi-drug resistant organisms (MDRO). A systemic review by Karki and Cheng (2012) analyzing 16 studies and four conference abstracts, and a meta-analysis by Afonso, Blot, and Blot (2016) analyzing four studies, determined statistically significant reductions in healthcare-acquired infections (HAI), including CLABSI, and colonization with multi-drug resistant organisms (MDRO) when ICU patients were bathed with CHG bath wipes. Similar results were found in a multi-center randomized trial of ICU patients by Climo et al. (2013); both hospital-acquired bloodstream

infections (BSI) and incidence of MDRO were significantly reduced with chlorhexidine bathing when compared to non-antimicrobial bathing wipes. A meta-analysis by O'Horo, Silva, Munoz-Price and Safdar (2012) analyzing 12 studies, and a meta-analysis by Shah, Schwartz, Luna, and Cullen (2016) examining six studies, as well as a randomized controlled trial by Bleasdale et al. (2007) focused solely on BSI and found a statistically significant reduction in BSI rate with CHG bathing. In addition to the aforementioned studies, CHG bathing is also supported by the Society of Healthcare Epidemiology of America (SHEA), the Infectious Disease Society of America (IFDA), the American Association of Critical-Care Nurses (AACN) and the CDC. Each of the aforementioned organizations recommends once daily bathing of ICU patients with CHG (ICT, 2013; Marschall et al., 2014; O'Grady et al., 2011; & SHEA, IDSA, AHA, APIC, & The Joint Commission, 2014). CHG bathing is given a Level I recommendation per the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) and the Canadian Task Force on Preventative Health Care for the prevention of BSI and MRSA infections (SHEA, IDSA, AHA, APIC, & The Joint Commission, 2014); while the 2011 guidelines for CLABSI prevention from the CDC gives a Level II recommendation to daily CHG bathing (O'Grady et al., 2011).

NBH Bathing Protocol

Previous baths consisted of nursing staff filling a basin with warm water and soap and wiping patients down with wash cloths. A wash cloth was used per body part: one for the face, one each arm, one for the chest, one each leg, one for the back, and one for the peri-area. In February, 2015, the ICU at Norton Brownsboro Hospital (NBH) instituted a change in practice moving from soap and water basin baths, or non-medicated bath wipes, to soap and water basin baths followed by the use of pre-packaged CHG impregnated bathing wipes. The rationale was

that the soap and water basin bath would clean visibly soiled skin and following with CHG impregnated wipes would decontaminate the skin. Based on the current recommendations from the AACN, CDC, IDSA, and SHEA it was decided that the frequency of bathing in the protocol would be one bath daily or one bath per 24 hours of ICU stay (ICT, 2013; Marschall et al., 2014; O'Grady et al., 2011; & SHEA, IDSA, AHA, APIC, & The Joint Commission, 2014) An example of a CHG bathing protocol outlining the proper use of the Sage CHG wipes is represented in Figure 1.

Purpose

The purpose of this project is to determine the nursing staff adherence rate to the CHG bathing protocol and to establish if any correlation exists between nursing staff adherence and patient characteristics, including body mass index (BMI), and severity of illness score used by Norton Healthcare including Case Mix Index (CMI), risk of mortality (ROM), and severity of illness (SOI). In addition, nursing staff adherence to CHG bathing will be examined to determine any impact on ICU patient outcomes, namely HAIs (CLABSI, CAUTI, and SSI).

Methods

This study utilized a descriptive, quasi-experimental, single-site retrospective electronic medical records (EMR) review design in order to determine nursing staff adherence to the CHG bathing protocol, patient characteristics that may affect CHG bathing adherence, and the impact CHG compliance has on patient events, namely the HAIs (CLABSI, CAUTI, and SSI). Prior to the initiation of the CHG bathing protocol, plastic bath basins (that were used multiple times) with soap and water or non-medicated bathing wipes were used to bathe ICU patients at NBH. In February, 2015 the ICU at NBH transitioned from using bath basins multiple times with soap and

water and non-mediated bath wipes to disposable basin baths followed by pre-packaged, CHG impregnated wipes. This decision was made in order to align nursing practice at NBH with the current evidence supporting the use of CHG bathing wipes.

Setting

NBH is a 175-bed community hospital located in Eastern Jefferson County and is part of the Norton Healthcare system in Kentucky. Despite its size, NBH boasts the honor of being the smallest hospital to obtain Comprehensive Stroke Center Status. The ICU at NBH consists of a total of 30 beds between two units, 3 East and 5 West. Both units perform as one collective ICU and have the same nursing and management staff. The NBH ICU specialties include but are not limited to cardiac, neurology, neurosurgery, pulmonary, medical, and surgical critical care services. This particular setting was selected as the initiation of CHG bathing protocol was recent, and a reliable time frame since initiation is known.

Sample

The sample consisted of medical records from 400 NBH ICU patients from which a random sample of 200 was generated, post initiation of CHG bathing from March, 2015 to May, 2017. Inclusion criteria for this study were: patients aged 18 years and older, no documented CHG allergy, greater than 24-hour ICU length of stay (LOS), presence of indwelling medical device (CVC, PICC, and F/C), and/or surgical procedure performed. All records from the March, 2015 to May, 2017, time frame meeting the inclusion criteria were selected.

Data Collection

Prior to data collection, approval from both the University of Kentucky Institutional Review Board (IRB) and the Norton Healthcare Office of Research and Administration

(NHORA) was obtained. A quasi-experimental, single site, retrospective EMR review design was utilized for this study. The Norton Healthcare Clinical Information Analysis Department (CIA) was contacted for data retrieval. Inclusion criteria were: patient records from March, 2015 to May, 2017, over 18 years of age, greater than 24-hour ICU LOS, and presence of an indwelling medical device (CVC, PICC, or F/C) and/or surgical procedure performed was provided to the CIA department. Variables including demographic information (age, sex, and race), admitting diagnosis, ICU LOS, presence of indwelling medical device (CVC, PICC, and F/C), patient characteristics (BMI, CMI, risk of mortality, and severity of illness scores), quantity of CHG baths received in the ICU, and patient events (CLABSI, CAUTI, and SSI) were requested for CIA to pull. Patient medical record numbers (MRN) were also requested in order to gain access to the patient's EMR. A total of 400 charts was provided from which a random sample of 200 was pulled using the simple random sample function in Microsoft Excel 2013. Per recommendations from the CIA, the medical records of the 200 randomly selected patients were accessed in order to verify the presence of F/C and CVC/PICCs. CVCs/PICCs and F/C are considered LDAs (line/drain/airways) in the Epic EMR. There was concern that an LDA may be pulled in favor of another, and manual verification of the presence of F/Cs and CVC/PICCs was necessary to ensure accuracy of the data.

Data Analysis

In order to describe patients' demographic characteristics, descriptive statistics including frequency distributions, means, and standard deviations (SD) were utilized. Categorical variables were assessed via Chi-square tests for individual samples or Fisher's exact test if any cell value was less than five. Continuous variables were analyzed using the Independent Samples *t*-test and

Mann-Whitney U test. All data analysis was conducted using SPSS version 24; an alpha level of .05 was used to establish statistical significance throughout.

Results

Sample Characteristics

A total of 200 patient records post-initiation of the CHG bathing protocol were reviewed. The sample was divided into CHG bathing adherent and non-adherent groups. Adherence, for this study, is defined as a patient receiving one CHG bath per 24 hours in the ICU. The mean age did not differ significantly between the two groups at 62 years for the non-adherent and 59 years for the adherent group. Males and females were equally represented in both groups at approximately 60% and 40% respectively. Caucasian patients made up a majority of both groups at 89.2% in the non-adherent and 83.6 in the adherent group. Overall, the two groups are demographically similar. Subject demographic information is summarized in Table A.

CHG Bathing Protocol Adherence and Patient Characteristics

Overall, compliance was lower than expected with only 61 patients or 30.5% of the sample receiving a CHG bath per 24 hours of ICU stay. Patient demographic characteristics were analyzed via Chi-square, Fisher's exact, and two-sided *t* test to establish if any relationship exists with adherence. No statistically significant relationship was identified between nursing staff adherence and age (p=.07), sex (p=.08), or race (p=.23). Patient characteristics (BMI, mortality scores, ICU LOS, presence of indwelling medical device/surgical procedure performed) were also analyzed alongside nursing staff adherence with Chi-square, Fisher's exact, two-sided *t* test, and Mann-Whitney U test as appropriate to establish any potential relationships. Again, no statistically significant relationships were observed when compared to nursing staff adherence.

Results of the statistical analysis are located in Table A; a comparison of ICU LOS between the adherent and non-adherent groups is represented in Table B.

Impact of CHG Bathing Adherence on Patient Outcomes (HAIs)

HAIs were low in the sample at 1.5 %. Only three HAI events were captured, all CAUTIs and all in the adherent group. This was the only statistically significant finding throughout the data analysis with a p value of .03. Per the Centers for Disease Control (CDC), the single most important risk factor for developing CAUTI is prolonged urinary catheter dwell time (CDC, 2017). Increased urinary catheter dwell time increases the chances of biofilm development and subsequent CAUTI (Trautner & Darouiche, 2004). CHG wipes are used on the patients' external peri-area; however, the wipe is not to come into contact with mucous membranes or the urinary meatus. This restriction rules out CHG use for Foley catheter care that would clean the meatus and rid the catheter tubing of developing biofilm, thereby aiding in the prevention of CAUTI.

Discussion

Charting Discrepancy/Care Discrepancy

The EPIC EMR system used by Norton Healthcare utilizes flowsheets for nursing staff to chart the care of their patients. In order for nursing staff to chart a CHG bath, an extra step is required when compared to charting a traditional soap and water basin bath. Baths are charted under the Daily Care/Safety Rounds flowsheet by nurses and patient care associates (PCAs) on the row labeled Hygiene by clicking "Bathed" from the drop down box. To capture both a soap and water basin bath in addition to the CHG bath, nursing staff must select both "Bathed" and "CHG Bath" on the Hygiene row. The option "CHG Bath" is also a few selections below "Bathed" and requires nursing staff to search for the option. Adding an additional step to the

charting process and requiring nursing staff to search for the "CHG Bath" option are potential barriers that may impact nursing staff's charting accuracy. After initiation of the CHG bathing protocol, the documentation of CHG baths was not audited by ICU management staff. This calls into question the accuracy of CHG bath charting by ICU nursing staff. An additional step added to complete a regularly performed charting task, already ingrained in nursing staff routine, increases the risk of the charting not being completed properly. Without audits that provide the medium needed to provide staff with feedback and coaching opportunities, improper charting continues. In order to address this discrepancy the data found in this study should be briefly shared with nursing staff during "Shift Starters" a pre-shift huddle that allows the ICU management team to share information with staff about protocols, events, and the current staffing plan of the unit. In addition, the proper charting procedure should be discussed at this time and screenshots of the procedure placed at nursing staff charting areas.

There is also the possibility that because this is a new practice and audits are not taking place that the CHG bathing protocol is not being followed by nursing staff. The same discussed with the possibility of charting discrepancy also applies here. Without oversight, it is possible that staff adherence may have started to decrease sometime after initiation. Also, the ICU at NBH is one of Norton Healthcare's "Alpha Units;" Alpha Units are designated units throughout the Norton Healthcare System that participate in trials of new protocols and/or medical supplies/devices. The possibility that nursing staff may experience "burnout" in regard to constant change, and disruption of their normal routine must be considered as a possible deterrent to adherence (Nyman, Bondas, Downe, & Berg, 2013). It is reasonable given the low adherence rate, based on nursing staff charting, to consider re-education of staff on the rationale behind CHG bathing and the proper documentation of CHG bathing during shift starters. In order

to optimize staff buy-in the use of a change theory or change process such as the Plan Do Study Act (PDSA) is recommended and endorsed by the Society for Critical Care Medicine (SCCM) (SCCM, 2017). This approach allows nursing staff input thereby increasing nursing staff buy-in and adherence. In addition, the ICU management team should also consider regular auditing of CHG bathing documentation.

This study did not exam charting patterns in relation to time since protocol initiation and would be valuable information for a future study. Trending documentation compliance since protocol initiation would have identified if compliance with charting was higher closer to initiation and then drifted off. Finally, par levels of CHG wipes were not tracked. It is possible that wipes may not have been available in order to complete the bathing protocol as prescribed.

CAUTI and CHG Bathing

Although CHG impregnated wipes are used to clean patients' peri-areas, they do not come into contact with the urethral meatus or Foley catheter tubing. Therefore, CHG wipes play no role in the removal of biofilms from the meatal area and catheter tubing. Given that three CAUTIs were captured in the adherent group, this may indicate that CHG bathing has little to no impact on the rate of CAUTI or simply may be an incidental finding. As catheter dwell time is a strong risk factor for CAUTI development, efforts to prevent CAUTI should focus on minimizing catheter days.

HAI Prevention Bundles

Overall, HAI events in the sample were very low at 1.5%, and none were CLABSI or SSI. The aforementioned studies by Bleasedale et al. (2007), Climo et al. (2013), Karki and Cheng (2012), and O'Horo et al. (2012) all demonstrated reduced rates of CLABSI and

colonization with MDRO that could lead to SSI after the initiation of CHG bathing protocols. However, the CHG bathing protocol is not the only intervention in place with the intent of reducing CLABSI rates. The Institute for Healthcare Improvement (IHI) central line insertion bundles consist of the following five interventions: hand hygiene prior to CVC insertion, maximal barrier precautions, chlorhexidine skin antisepsis, optimal site selection (i.e., avoiding the femoral site in adults), and daily review of line necessity (Furuya et al, 2016). Adherence with this bundle was shown to reduce CLABSI per the national study conducted by Furuya et al. (2016). The IHI bundle is utilized by Norton Healthcare as an element to reduce CLABSI rates. In addition to the IHI bundle and CHG bathing, Norton Healthcare also requires regular CVC cap changes, use of Curos antiseptic caps on all ports (both CVC and intravenous tubing ports), and at least weekly CVC dressing changes. The combination of these interventions complement one another and lead to the reduction in CLABSI; no one intervention is solely responsible.

Limitations

The limitations of this study include the small sample size and the retrospective EMR review design, both of which may affect the validity of the results. Smaller sample sizes minimize the statistical power and therefore reduces greatly the strength of the statistical conclusions. Utilizing a retrospective EMR design requires the evaluation of self-reported documentation of completed nursing tasks. There is always the risk that documentation is not accurate. CHG baths could be falsely documented, or nursing staff may continue charting baths as they did prior to the protocol thereby omitting documentation that a CHG bath was given. Without real-time observation of nursing staff, the data extracted must be factored into the validity of the study's results. In addition, this was a single site review; therefore, results cannot be generalized to all of the ICUs in Norton Healthcare. Finally, nurse/PCA staffing patterns were

not evaluated. Nursing staff patterns have been shown to improve patient outcomes, including infection rates in ICU patient populations (Blegen, Goode, Spetz, Vaughn, & Park, 2011). On shifts with suboptimal staffing, there is a higher chance that some nursing tasks are not completed as prescribed.

Conclusion

The CHG bathing adherence rate was surprisingly low in this sample. It is reasonable to hypothesize that the charting of CHG baths may reflect omission of charting since an additional step is required in order to properly document a CHG bath when compared to the charting of a traditional soap and water basin bath. In addition, it is also reasonable to question whether or not CHG baths are being performed; charting may reflect actual nursing staff adherence. ICU management staff should consider re-educating ICU nursing staff on the rationale behind CHG baths as well as proper documentation of CHG baths during shift starters. Upon completion of re-education, ICU management may wish to consider chart auditing as well as real-time observation of nursing staff bathing practices. The development of three CAUTIs in the adherent group likely represents an incidental finding as catheter dwell time is the most important risk factor for developing CAUTI, and CHG baths are not used to clean the urethral meatus and catheter tubing. Overall, the HAI rate was low in this study at 1.5%. No CLABSI or SSIs were captured in this sample and may represent the effects of bundled care for infection prevention rather than solely the impact of CHG bathing. Future studies may benefit from including multiple ICUs within the Norton Healthcare System, assessing nurse staffing patterns throughout the study, evaluating adherence rates in regard to time-since-protocol initiation, and incorporating real-time observation of nursing staff bathing practices. In addition, a qualitative component evaluating both patient and nursing staff perceptions of the CHG wipes/bathing

protocol would be valuable information. The aforementioned recommendations would add power to statistical analysis and provide valuable information in regard to the factors affecting CHG bathing and in turn, patient outcomes.

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Tables

Table 1: Sample Characteristics by Group

Sample Characteristics by Group			
	CHG Bath Protocol Adherence		*p*
	No (n=139)	*Yes (n= 61)*	
	n(%)	*n(%)*	
Demographics			
Age, years Mean (SD)	62 (14.7)	59 (16.7)	.27
Sex			
Male	79 (56.8)	36 (59)	.08
Female	60 (43.2)	25 (41)	
Race			
African	8 (5.8)	9 (14.8)	.23
American/Black	124 (89.2)	51 (83.6)	
Caucasian/White	7 (5)	1 (1.6)	
Other			
Patient Characteristics			
BMI, Mean (SD)	29.4 (8.8)	30.5 (8.9)	.44
CMI, Mean (SD)	3.8 (2.6)	4.1 (3.9)	.48
SOI, Mean (SD)	2.9 (.75)	2.8 (.8)	.21
ROM, Mean (SD)	2.7 (.9)	2.5 (.9)	.13
ICU LOS, Median (SD)*	73 (108)	61 (61)	.09
Indwelling Medical Device/Surgical Procedure			
CVC/PICC	58 (41.7)	27 (44.3)	.11
F/C	135 (97.1)	25 (95.1)	.42
Surgical Procedure	84 (60.9)	34 (55.7)	.46
Events (HAIs) (n)			
CLABSI	0	0	N/A
SSI	0	0	N/A
CAUTI	0	3	.03
Legend: BMI=Body Mass Index, CMI=Case Mix Index, CVC= Central Venous Catheter, F/C=Foley Catheter, ICU=Intensive Care Unit, LOS=Length of Stay, PICC=Peripherally Inserted Venous Catheter, ROM=Risk of Mortality, SOI=Severity of Illness			
*Notes: *Mann-Whitney U test*			

Table 2: ICU LOS by Group

ICU LOS by Group			
	Median	Minimum	Maximum
Non-Adherent	73	25	478
Adherent	61	25	342
Legend: ICU (Intensive Care Unit), LOS (Length of Stay)			

Figures

Figure 1: Sample CHG Bathing Protocol