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Original Article

Reducing Ventilator Associated Pneumonia in the NICU through oral care education: A quality improvement project

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ABSTRACT

Background: Inadequate oral care in the Neonatal Intensive Care Unit (NICU) can lead to Ventilator Associated Pneumonia (VAP). VAP rate was reported at 2.52 per 1000 ventilator days for the 12 months prior to intervention. A root cause analysis of VAPs during this period revealed only 70% compliance with oral care. VAP contributes to higher costs for the hospital, patient pain and suffering, morbidity and mortality, length of time on mechanical ventilation and increased hospital length of stay. This Quality Project aims to reduce VAP in the NICU through multidisciplinary re-education on the importance of oral care, and fostering an interdisciplinary oral care team of Respiratory Therapists and Registered Nurses.

Method: An IRB approved interventional pre and post intervention review of VAP rate was conducted on intubated neonatal patients from June 1, 2015–May 31, 2017. Intervention consisted of education perform as an interdisciplinary oral care team. Education was coordinated between Respiratory (RT) and Nursing (RN) educators, Lactation, and unit leaders to ensure standardized education to all staff. An oral care poster was created and presented to both RT and NICU RN staff at department meetings. An oral care PowerPoint was created and sent to all NICU RN's and was required as annual mandatory education for all RT's. Encouragement was provided through random chart audits from June 2016–May 2017, praising staff that coordinated care, and reminding staff who did not through friendly face to face interaction and email of the importance of routine, coordinated oral care.

Results: NICU VAP rates dropped during June, and came back up in July 2016 and dropped again in March 2017. Chart review revealed insufficient oral care (72% and 78%) in the two days prior to VAP events. Oral Care poster and education were re-introduced in August 2016 and April 2017. NICU VAP rates post intervention, June 2016–May 2017, was reported as 0.78 per 1000 ventilator days.

Conclusions: Identifying the primary factor through VAP root cause analysis made us aware of a VAP bundle component that was not being routinely followed. Having identified oral care as a problem in our unit enabled us to form an educational intervention with a standardized oral care technique that was effective in increasing the frequency and efficacy of oral care. Utilizing a multidisciplinary team for oral care fosters a sense of importance and responsibility to the staff and improved collaboration in care.

1. Introduction

Ventilator Associated Pneumonia (VAP) is a commonly hospital-acquired infection, and a leading cause of morbidity and death in neonates (Gaynes et al., 1996). VAP can cause serious complications in neonates and premature infants with a reported rate at 2.7–10.9 per 1000 ventilator days in developed countries (NNIS, 2004). In 2009 the Joint Commission sanctioned the use of VAP rates as a nursing-sensitive performance measure (The Joint Commission, 2009). The Institute for Healthcare Improvement demonstrated the differences between protocols for VAP in infants and children and those for adults in a How-to Guide for prevention of ventilator associate Pneumonia in 2012. This handbook on VAP prevention made the following recommendations for neonatal units: elevation of head of bed between 15 and 30° in neonatal units, understanding of oral care appropriate to the age and risk of patients, keeping the oral cavity clean, maintenance and exchange of ventilator circuits when visibly soiled, careful hand hygiene before and after contact with patients and equipment, and storage of oral

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aspiration devices in a plastic bag when not in use (Institute for Healthcare Improvement, 2012). In January of 2013 evidence-based practices to prevent VAP were implemented across the United States as a national patient safety goal (The Joint Commission, 2013).

Prevention of VAP at our facility has been targeted primarily through a bundle of interventions designed to reduce the exposure of infants to pathogens. This involves the simultaneous application of preventative strategies utilizing a checklist. The Institute for Healthcare Improvement demonstrated the differences between protocols for VAP in infants and children and those for adults in a How-to Guide for prevention of ventilator associate Pneumonia in 2012. This handbook on VAP prevention made the following recommendations for neonatal units: elevation of head of bed between 15 and 30° in neonatal units, understanding of oral care appropriate to the age and risk of patients, keeping the oral cavity clean, maintenance and exchange of ventilator circuits when visibly soiled, careful hand hygiene before and after contact with patients and equipment, and storage of oral aspiration devices in a plastic bag when not in use (Institute for Healthcare Improvement, 2012). There are several studies showing decreased VAP after preventative bundles were applied (American Thoracic Society Infectious Diseases Society of America, 2005), (Ceballos et al., 2013), (Tayel et al., 2017).

With bundle elements in place since 2012, the VAP rate at our facility from June 2015–May 2016 was reported at 2.52 per 1000 ventilator days (Unpublished Data). The bundle elements at our facility include those recommended by Solutions for Patient Safety data coalition; assessing readiness to extubate daily, head of bed elevated 30°, minimize disruption/disconnection of the circuit, oral hygiene (Safety, 2011), as well as hand washing, use of protective personal equipment, routine changing of respiratory and suction equipment, and scheduled position changes. Oral care is standardized to be performed preferentially with maternal or donor breast milk due to its ability to change the oral microbiota (Sohn et al., 2015), and protect against infectious morbidities (N. Rodriguez, 2016). If no breast milk is available then sterile water (F. G. Rodriguez, P. Calvo, MC. Sanchez-Chavez, F. Pallas-Alonso, CR. Romero deAlba, C., 2017) for patients < 32 weeks or Biotene if > 32 weeks (Stefanescu et al., 2013) is utilized.

Despite our VAP rate occurring within the national average, concern remained to find any factor that might reduce our rate of infection to our goal of less than 1 per 1000 ventilator days. A root cause analysis of all VAP events during June 2015–May 2016 was conducted and we found > 93% compliance with all aspects of the bundle except oral care. Oral care compliance was only 70% during the same period (Unpublished Data).

Because neonates have no teeth or are enteral feeding there is a delusion that microorganisms have nothing to adhere to. However, the mucosa, tongue, gingival ridges, and oral endotracheal tube all have areas for growth. Marino et al., showed that invasively ventilated patients had improvement in their oral health after brushing with a sponge swab or dental brush with equal effectiveness in the reduction of biofilm and gingivitis (Marino et al., 2016). Bassan, Peres, and Franco (2018) stress the importance of maintaining a humid oral mucosa for both patient comfort and reduction in the hyposalivation that can lead to bacterial growth. Studies have shown that continued educational training for healthcare workers may impact infection rate and improve compliance with bundle elements (CDC, 2004).

This article seeks to describe a project to decrease VAP rates by increasing bedside clinicians understanding of oral care as an infection control measure as well as assessing the VAP rate before and after an educational intervention. The educational intervention included a summary of the VAP pathophysiology and how a standardized approach to oral care reduces the risk of infection. In addition, we discussed barriers to the provision of oral care.

2. Methods

The University of California San Diego (UCSD) Institutional Review Board approved the quality study (#180920). We prospectively assessed compliance targeted measures aimed at preventing VAP, and VAP rate against baseline data.

This approach combined an educational program to encourage adoption of recommended practice with regular reminders, feedback on performance, and mandatory education.

Objective: The purpose of this project was to reduce VAP in the NICU through multidisciplinary re-education on the importance of oral care, and fostering an interdisciplinary oral care team of Respiratory Therapists and Registered Nurses.

Design: Pre- and post-intervention observational study. The study took place in a closed, multidisciplinary out born NICU with a total capacity of 33 beds. A prospective, intervention quality project consisting of 3 phases was conducted: phase 1 was a baseline period (11 months) and assessing barriers to care, phase 2 was an intervention/education period (60 days), and phase 3 was a post intervention period (11 months). The total duration of the study was 24 months. A total of 1984 invasive ventilator-days were observed in the fiscal year prior to intervention, and 2563 invasive ventilator days were observed in the fiscal year following the intervention. Hand Hygiene data was also collected during the pre and post intervention period.

Identification: VAP's were identified by our infection control department with no changes in definition during the study period.

Barriers to Care: After discussion with staff, barriers to implementation of oral care element included breast milk not stored in patient room, concern with costs for opening sterile water bottle each time oral care needed completion, no Biotene available in stock, demanding workloads, and lack of understanding of the benefits of breast milk. Plan to overcome barriers included obtaining needed supplies, a multi-disciplinary approach, and education. Small 3 ml sterile water vials were purchased for oral care use and staff taught to recognize the difference in vials from the saline vial. Biotene bin par level was increased to 6 to ensure Biotene in stock when needed. Use of a multidisciplinary approach ensured the responsibility of oral care resided on both care providers to alleviate some of heavy workload responsibility. Education was specifically designed to include the following benefits of breast milk over other products; antibodies (Triantis et al., 2018), immunoglobulins capable of pathogen recognition (Cacho and L. RM, 2017), oligosaccharides (Andreas et al., 2016; Bode, 2015; Cacho and L. RM, 2017; Triantis et al., 2018), mucines with antiviral capabilities, pancreatic secretory trypsin inhibitor to protect or repair intestines, anti-inflammatory and pro-inflammatory cytokines (Booker et al., 2013).

Interventions: Education on the importance of oral care, with focus on the benefits of breastmilk and encouragement to perform as an interdisciplinary oral care team. This strategy was devised to influence factors determining healthcare provider behavior: predisposing factors (knowledge, attitudes, and beliefs); enabling factors (access); and reinforcing factors (positive reinforcement through one on one discussion, emails, and performance recognition. In April of 2015 a multidisciplinary task force was formed, consisting of Respiratory Therapy (RT) and Nursing (RN) educators, Lactation, and unit leaders, to design an educational program that ensure standardized education on VAP reduction and oral care to all staff. An oral care poster was created and presented to both RT and NICU RN staff at department meetings in May, and then placed on the breast milk refrigerator as a reminder. The centerpiece of the educational program consisted of a 1-hr mandatory slide presentation presented in June as part of annual mandatory education.

The slide presentation focused on the epidemiology, morbidity, mortality, risk factors, and pathophysiology of VAP and its preventive measures. It specifically focused on the importance of oral care and breast milk for prevention of disease, and a multi-disciplinary approach

to care including procurement of needed supplies. Oral care instruction included using a foam swab with application to the palate, tongue, buccal mucosa, superior and inferior gums, and along the endotracheal tube. The slide show was sent to all NICU RN's through email, and was required as annual mandatory education for all RT's. Encouragement was provided to bedside clinicians through random chart audits from June 2016–May 2017, praising staff that coordinated care, providing performance recognition at staff meetings, and reminding staff who did not through friendly face to face interaction and email of the importance of routine, coordinated oral care.

Compliance assessment consisted of four 4-wk periods (before the intervention and 1 month, 6 months, and 12 months thereafter.

3. Results

Hand-hygiene compliance was initially high (91.3%) and remained stable (91.5%) over time. Compliance with HOB elevation, minimize disruption/disconnection of the circuit, routine changing of respiratory and suction equipment, were maintained at > 80% compliance. Compliance with oral care was initially low (70%) and increased steadily (92%) over time (28.57% change). During the year after education there were two VAP's, one in July 2017 and one in November 2017. Root cause analysis of those cases revealed that in the 48 h prior to VAP, compliance with oral care bundle had dropped to 72% in the July case, and 80% in the November case. Due to the reduction in oral care compliance re-education was brought back to departmental meetings. VAP rate was reduced from 2.52 per 1000 ventilator days in the fiscal year prior to the intervention to 0.78 per 1000 ventilator days in the fiscal year following the intervention (−69.05% change).

4. Discussion

Oral Care standardization between disciplines and encouraging interdisciplinary collaboration can decrease the Ventilator Associated Pneumonia rate. Over time drifts in practice and knowledge will require continuing re-education. The CDC in 2012 showed that continued educational training for healthcare workers may impact infection rate and improve compliance with bundle elements (American Thoracic Society Infectious Diseases Society of America, 2005), (Ceballos et al., 2013), (Tayel et al., 2017). The decreased rate of pneumonia after ensuring bundle compliance is a similar finding to other studies, with oral care playing an important role in the reduction in pathogens (F. G. Rodriguez, P. Calvo, MC. Sanchez-Chavez, F. Pallas-Alonso, CR. Romero deAlba, C., 2017). The limitations to our study deserve comment. Although we did monitor hand-hygiene compliance, due to the nature of the study there are other confounding variables that were not assessed that may impact outcomes. Confounding variables in the bundle that we were unable to assess compliance consistently included use of PPE, scheduled position changes, and disconnection from the ventilator circuit. Increased attention to the VAP prevention and bundle elements alone may have impacted the outcome. Also, as oral care mediums and supplies change, outcomes may vary from the study.

5. Conclusions

Our active, long-lasting program for preventing ventilator-acquired pneumonia successfully increased compliance with preventive measures directly dependent on healthcare workers' bedside performance. The multidimensional framework was critical for this marked, progressive, and sustained change.

Implications for practice

Oral care should be utilized as part of a comprehensive bundle for the prevention of VAP. Education on the importance of breast milk, maintaining a moist oral environment, and utilizing multidisciplinary teams to assure bundle compliance are necessary. Education must be repeated to ensure sustained reduction in VAP.

Disclosure

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jnn.2019.01.001.

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