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An Observational Study to Compare Oral Hygiene Care With Chlorhexidine Gluconate Gel Versus Mouthwash to Prevent Ventilator-Associated Pneumonia

To the Editor—Ventilator-associated pneumonia (VAP) is defined as pneumonia that developed 48 hours or longer after the use of mechanical ventilator. Most importantly, it can significantly prolong length of hospital stay and increase mortality of critically ill patients.[1,2] To prevent this fatal disease, several interventions were initially constituted into the ventilator care bundles by the Institute for Healthcare Improvement (IHI): elevation of head, daily sedation vacation, and assessment of readiness to extubate, daily oral hygiene care, and assessment of stress ulcer and deep venous thrombosis prophylaxis.[3] Oral hygiene care using chlorhexidine gluconate (CHG) as an element of the ventilator bundle is supposed to decontaminate the mouth, avoid aspiration of contaminated secretions into the respiratory tract, and prevent VAP.[4–6] CHG is provided in different formulas such as mouthwash or gel; however, studies comparing the usefulness of these 2 CHG formulas in preventing VAP are lacking. At our institution, we implemented a bundle that included oral hygiene care using CHG mouthwash, and we then changed to CHG gel. We comparatively assessed the effect of CHG gel versus CHG mouthwash on reducing the risk of VAP in the ICU.

This study was conducted in 2 surgical ICUs at a regional teaching hospital that has a total of 26 adult ICU beds and 1 intensivist bed. In these 2 ICUs, a ventilator bundle was implemented in 2015 that included (1) 30°–45° elevation of the head, (2) daily interruption of sedation, (3) daily assessment of readiness to extubate, (4) performance of oral hygiene care with 0.2% CHG mouthwash 3 times a day, and (5) discharging excess water from the pipeline. In June 2016, the oral antiseptic agent was changed to 0.2% CHG gel, and other care bundles were maintained without change. To evaluate the effect of CHG gel on the reducing risk of VAP, we collected from the infection-control practitioner the numbers of ventilator days and VAP cases monthly between June and December 2016 (ie, gel phase). The rate of VAP was defined as the number of cases of VAP per 1,000 ventilator days. As a baseline measurement for comparison of the effect of oral care of CHG gel versus CHG mouthwash in relation to VAP incidence, we retrospectively collected the same data for January to May 2016 (ie, mouthwash phase).

During the gel period, 5 cases of VAP were recorded, and the total number of ventilator days was 2,724. Overall, the rate of VAP was 1.84 per 1,000 ventilator days. During the mouthwash phase, a total of 5 episodes of VAP were recorded in 1,939 ventilator days, for a VAP rate of 2.58 per 1,000 ventilator days. In the ICU with 16 beds, the rate of VAP declined from 3.08 per 1,000 ventilator days during the mouthwash phase to 2.81 per 1,000 ventilator days during the gel phase. In the other ICU with 10 beds, the rate of VAP declined from 1.55 per 1,000 ventilator days during the mouthwash phase to 0 per 1,000 ventilator days during the gel phase. Additionally, we observed that oral care using the CHG gel took the nurse 15 minutes each time, but oral care required 20 minutes when CHG mouthwash was used. Moreover, the average cost of CHG gel for 1 month is US$285.28 (8,938 New Taiwan Dollars [NTD]), which is less than CHG mouthwash at US$622.40 (19,500 NTD).

Although oral hygiene care using CHG can effectively reduce the risk of VAP in critically ill patients from 25% to ~19%,[7] until now, there has been no evidence regarding which CHG formula, gel or mouthwash, is more cost-effective in the ICU. In this survey, we found that the VAP rate could be reduced after CHG mouthwash was replaced with CHG gel for oral hygiene care. This finding may be explained by the effectiveness of CHG gel for performing oral hygiene in previous studies.[8,9] A double-blind placebo-controlled multicenter study in ICUs showed that antiseptic decontamination of gingival and dental plaque with a CHG gel significantly decreased the oropharyngeal colonization by aerobic pathogens in ventilated patients.[8] Another study with handicapped children further confirmed that CHG gel was significantly more effective than either the mouthwash or spray in controlling dental plaque.[9] Therefore, in line with our finding, oral hygiene care using CHG gel seems to be more effective at reducing VAP than CHG mouthwash.

In addition to the clinical benefit of CHG gel, we observed that the use of CHG gel required less time than CHG mouthwash in oral hygiene care provided by critical care nurses. Therefore, the use of CHG gel is a better choice than mouthwash in clinical nursing practice. Finally, regarding medical cost, we also found the cost of CHG gel to be less than

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that of mouthwash. Overall, our finding suggests that oral hygiene care using CHG gel is more practical and cost-effective than using CHG mouthwash in surgical ICUs.

This study has several limitations. It was conducted in a single institution in a short duration. The method of oral hygiene care and the cost of CHG may be different from other ICUs. Therefore, our finding may not be generalizable to other hospitals, and a further large-scale study is warranted to confirm our findings. In conclusion, CHG gel is a better choice than CHG mouthwash in oral hygiene care for preventing VAP.

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Does Second Place Count? Lessons from a Major Discrepancy Between Carbapenem-Resistant *Klebsiella pneumoniae* and Carbapenem-Resistant *Enterobacter cloacae* in a One-Year Follow-Up Study

To the Editor—Carbapenem-resistant Enterobacteriaceae (CREs) have become one of the most prevalent agents in nosocomial infections, and they are associated with poor outcomes.[1] In many Brazilian hospitals, *Klebsiella pneumoniae* carbapenemase (KPC)–producing *K. pneumoniae* (*Kp*), a main representative of the CRE group, has reached endemic levels and has been responsible for high morbidity and mortality rates.[2,3]

Since the emergence of KPC *Kp*, practically no other microorganism has managed to achieve prevalence levels as severe as those achieved by KPC *Kp*.[2,4,5] Some studies have shown the emergence of *Enterobacter* spp, especially *Enterobacter cloacae* and *Enterobacter aerogenes*, as a reflection of an increased prevalence rate, and they implicate CREs as one of the main bacteria with the ability to acquire and develop antimicrobial resistance, including carbapenem agents.[6,7]

In the past few years, the emergence of *Enterobacter* spp has been considered a second epidemic subsequent to the epidemic wave of KPC-producing microorganisms. However, in Brazil, few data are available to reveal how this microorganism has evolved over time, despite its recognized clinical and epidemiological status.

To verify the crude prevalence rate of CREs and to recognize a possible second potential CRE agent and assess its differences in relation to the most prevalent CRE, a retrospective survey from January 1 to December 26, 2016, was conducted at a tertiary hospital in Porto Alegre, Southern Brazil.

Identification of bacterial species as well as an antimicrobial susceptibility profile were initially performed using an automated broth microdilution system (MicroScan, Beckman Coulter, Brea, CA); the results were confirmed using the disk diffusion method. Determination of the resistance mechanism attributable to carbapenem agents was performed by applying a synergistic test with phenyl-boronic acid and ethylenediamine tetra-acetic acid for detecting KPC and metallo-betalactamase enzymes, respectively, and by enzymatic inhibition using clavulanic acid and cloxacillin for detecting extended-spectrum β-lactamases (ESBLs) and *Amp*C enzymes, in that order, as previously described.[2]