Evidence Based Practice Critically Appraised Topic

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Case Scenario:

A 56 year-old female is admitted to the Intensive Care Unit (ICU) for exacerbation of Chronic Obstructive Pulmonary disease (COPD). After failed attempts with medications, she deteriorates rapidly and subsequently needs intubation. After three (3) days of mechanical ventilation, her chest x-ray reveals pneumonia, despite oral cares with chlorhexadine.

Clinical Question:

Does the use of chlorhexidine during orals cares on mechanically ventilated, adult ICU patients decrease the risk of ventilator-associated pneumonia (VAP) versus the use of dental brushing with chlorhexidine?

Articles:

Chlebicki, M., & Safder, N. (2007, February 1). Topical chlorhexidine for the prevention of ventilator-associated pneumonia: A meta-analysis. *Critical Care Medicine*, 35 (2), pp. 595-602.

Pobo, A., Lisboa, T., Rodriguez, A., Sole, R., Magret, M., Trefler, S., et al. (2009, August 24). A randomized trial of dental brushing for preventing ventilator-associated pneumonia. *Chest*, 136 (2), pp. 433-39.

Critical Review of Study:

Chlebicki & Safder (2007) completed a meta-analysis providing Grade A, Level 1a evidence and Pobo et al (2009) conducted a single-blind, prospective, randomized study providing Grade B, Level 2a. The meta-analysis, conducted by Chlebicki & Safder (2007), included a review of randomized controlled trials evaluating efficacy of topical chlorhexidine applied to the oropharynx vs. placebo or standard care for prevention of VAP. Pobo, et.al. (2009) conducted a single-blind, prospective, randomized study of 147 adult ICU patients using chlorhexidine with oral cares (standard group) and also the use of an electric toothbrush (toothbrush group).

In Chlebicki & Safder (2007) study, seven trials enrolled 1,650 patients; 812 patients received a preparation of topical chlorhexidine applied to the oral mucosa and 838 patients received the comparator. Of the 838 patients not receiving chlorhexidine, 512 patients received placebo; 35 patients received standard oral care, and in one study, the control group (291 patients) received a phenolic oral rinse (Listerine). Two studies, conducted in cardiothoracic ICUs, accounted for 55.4% of all the patients forming our population for the meta-analysis (443 in treatment groups and 471 as controls). The remaining five studies were conducted in medical or medical-surgical ICU's.

In Chlebicki & Safder's (2007) study, seven randomized controlled trials met the inclusion criteria. Topical chlorhexidine resulted in a reduced incidence of VAP (relative risk, 0.74; 95% confidence interval, 0.56–0.96; p=02) using a fixed effects model. Using the more conservative random effects model, the point estimate was similar (relative risk, 0.70; 95% confidence interval, 0.47–1.04; p=.07), but the results failed to achieve statistical significance. The I2 test showed moderate heterogeneity. Subgroup analysis showed that the benefit of chlorhexidine was most marked in cardiac surgery patients (relative risk, 0.41; 95% confidence interval, 0.17– 0.98; p= .04). There was no mortality benefit with chlorhexidine although the sample size was small.

In the Pobo, et.al. (2009) study, the sample size required to achieve a 50% reduction in suspected VAP, based on a VAP rate of 20% in the standard group, with an 80% power and α error of 5%, was calculated to be 200 patients in each group. The incidence of VAP is reported as episodes per 1,000 days of MV. Discrete variables are expressed as counts and percentages, and continuous variables are expressed as means and SDs or median and inter-quartile range. For the demographic and clinical characteristics of patients, differences between groups were assessed using $\chi 2$ test or Fisher exact test for categorical variables and Student t test or Mann-Whitney test for continuous variables. The results are expressed as odds ratios (ORs), and p values with 95% confidence interval (CI). The risk of VAP developing was assessed by Cox proportional hazards regression, adjusting for APACHE (acute physiology and chronic health evaluation) II score at admission and for admission diagnosis. The significance level of all the analyses was defined as $p < 0.05$.

Results:

Seven randomized controlled trials met the inclusion criteria in the Chlebicki & Safder's (2007) meta-analysis study. They concluded that topical chlorhexidine resulted in a reduced incidence of VAP. Using the more conservative random effects model, they reported the point estimate was similar, but the results failed to achieve statistical significance. The I2 test showed moderate heterogeneity. Subgroup analysis showed that the benefit of chlorhexidine was most marked in cardiac surgery patients in the meta-analysis study by Chlebicki & Safder (2007). There was no mortality benefit with chlorhexidine although the sample size was small.

On the other hand, Pobo, et.al. (2009) concluded that in the single-blind study, incidence of suspected VAP was 22.4% (33 of 147 patients). The effect of intervention decreased the risk of suspected pneumonia. According to Pobo, et.al. (2009), difference was found in the time for VAP to develop between groups. There were no significant differences in VAP rate between the standard group (18 of 73 patients; 24.7%) and the toothbrush group (15 of 74 patients; 20.3%). VAP was documented after a median of 4 days in both groups; 61.9% of episodes were early onset VAP. The results of the Pobo, et.al. (2009) study showed there were no episodes of VAP in

the subset of patients with concomitant antibiotic use. Incidence of suspected VAP per 1,000 days of MV was 25.89 days in the standard group and 20.68 days in the toothbrush group. No differences were found in early onset VAP incidence.

Clinical Bottom Line:

Chlebicki & Safder's (2007) meta-analysis study showed that topical chlorhexidine is beneficial in preventing VAP; the benefit is most marked in cardiac surgery patients. A large randomized trial is needed to determine the impact of topical chlorhexidine on mortality. Pobo, et.al. (2009) single-blind study was to first evaluate the contribution of an intensive oral hygiene protocol using electric tooth brushing to prevent VAP. The findings suggest that the addition of electric tooth brushing to standard oral care with 0.12% chlorhexidine digluconate was not effective for prevention of VAP. The intervention was simple and safe but did not reduce the use of antibiotics or health-care resources. Both of these studies did prove that the use of chlorhexidine does reduce the incidence of VAP, but Pobo, et.al. (2009) was unable to prove that the use of an electric tooth brush is just as effective as manual brushing.

Strength:

The strength of the studies showed that the use of chlorhexidine is, in fact, effective in the reduction and prevention of VAP. The single-blind study showed that the reduction or elimination of VAP incidences did not improve with the use of a tooth brush when using chlorhexidine.

Implications for Practice:

The relevance of these studies to our practice demonstrates that the use of chlorhexidine is imperative to the reduction and elimination of ventilator-associated pneumonia in the adult ICU population. Oral cares completed every four hours, or every eight hours at a minimum, is a major key player. Both of these studies have shown that the use of chlorhexidine has proven to reduce or eliminate VAP's; which in turn decreases LOS and costs of healthcare. The impact of these evidence-based studies has demonstrated that the reduction of VAP is directly related to the use of chlorhexidine. Topical application of chlorhexidine is useful for preventing VAP in mechanically ventilated patients.