Reduction of Incidence, Mortality And Length of Stay With VAP Care in COVID-19 And other Respiratory Infections in Intensive Care Unit By Improving Oral Hygiene-A Systematic Review And Meta Analysis

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Abstract- *The objective of this review was to evaluate Reduction of Incidence, Mortality and Length of Stay with Ventilator Associated Pneumonia (VAP) in COVID-19 and Nosocomial Respiratory Infections in Intensive Care Unit in adults 18 years and over.*

Introduction*: Inclusion criteria: Patients with nosocomial and respiratory and covid 19 were included with the use of chlorhexidine or other topical agents or devices used for oral hygiene maintenance in ICU patients compared to a placebo product or usual care were included.*

Methods*: Databases to be searched include PubMed, Google scholar and Cochrane Following the search, titles and abstracts will be screened by two independent reviewers for assessment against the inclusion criteria for the review. The full text of selected citations will be assessed in detail against the inclusion criteria, and studies selected for retrieval will be assessed by two independent reviewers for methodological validity using JBI critical appraisal tools. Studies will not be excluded based on their quality assessment.*

Results*: 41 Studies met the inclusion criteria for review were taken and those studies were statistically pooled studies and outcomes were measured. All the studies demonstrated the by reducing Incidence, mortality and length of stay.*

Conclusion*: VAP Care can help reduce the risk of acquiring lung infection as well as improve ICU efficiency by reducing the staff time needed for manual suctioning. VAPCare is a safe system that did not cause any injury or side effects in the patient population, and also performed as intended*
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Keywords- VAP, Mortality, Length of stay and COVID-19

I. INTRODUCTION

The cause of death for Intensive Care Unit (ICU) patients is primarily associated with their critical illness, for which they have been admitted, and secondly hospital acquired illness known as nosocomial infections. Ventilator associated pneumonia (VAP) is a nosocomial infection associated with mechanical ventilation, responsible for 86% of all nosocomial pneumonias inside the hospital. [1] This infection develops within 48 hours or longer after mechanical ventilation is given by means of an endotracheal tube or tracheostomy. It occurs in 9–27% of all intubated patients [2]. In mechanically ventilated patients, the incidence increases with duration of ventilation. The risk of VAP is high in early course of hospital stay, and it is estimated to be 3% per day during the first 5 days of ventilation, 2% per day during 5 to 10 days of ventilation. It results from the invasion of the lower respiratory tract and lung parenchyma by microorganisms. Intubation compromises the integrity of the oropharynx and trachea and allows oral and gastric secretions to enter the lower airways. Patients with VAP, COVID-19 and other respiratory problems were unable to breath on their own hence, they are intubated with endotracheal tube (ETT). Mechanically ventilated patients who suffer from poor oral hygiene are exposed to the harmful accumulation of oral secretions and the initiation of VAP. Proper oral care by qualified care givers can reduce the incidence of VAP. Comprehensive oral care should be considered as a part of the medical treatment when a patient is admitted to the ICU to lower the incidence of VAP. Oral care of ventilated patients in the intensive care units, for prevention of ventilator-associated pneumonia, is an intervention with high clinical relevance, which leads to decrease in morbidity and mortality in the ICU [3].

A.Review question

What is the effectiveness of VAPcare for reducing incidence, Mortality, Length of stay and in adults 18 years and over.

B.Inclusion criteria: Participants

Articles that were considered for inclusion criteria was participants (18 years of age or older) with cardiac diseases, trauma, pneumonia, pulmonary, digestive, nosocomial infections and neurological diseases and covid-19.

C.Intervention

The intervention of interest was considered as Agents used for improved oral hygiene.

D.Comparator

This review considered studies that compared the intervention of oral hygiene with Usual care.

E.Outcomes

This review will consider studies that include the following outcomes in adults with reduction of incidence, mortality and length of stay.

F.Types of studies

Randomized control trail, observational, Retro prospective cohort studies, retrospective studies and prospective studies are included.

II. METHODS

A.Search strategy

The systematic review was conducted by primary electronic database search. Searches were conducted in PubMed, Google scholar and Cochrane data bases. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was developed for this project. Studies published in English language will be included. All the studies in the database from its inception to the present date will be considered.

B.Study selection

Following the search, all identified citations were collated and uploaded into EndNote and duplicates were removed. Titles and abstracts were screened by two Assessment of methodological quality independent reviewers for assessment against the inclusion criteria for the review. The full texts of potentially eligible studies were retrieved and assessed in detail against the inclusion criteria by two independent reviewers. Full-text studies that did not meet the inclusion criteria were excluded. Any disagreements that arose between the reviewers were resolved through discussion.

C.Data extraction

Data were extracted from studies included in the review by two independent reviewers The data extracted included specific details about the interventions, populations, study methods and outcomes of significance to the review question. Any disagreements that arose between the two reviewers were resolved through discussion.

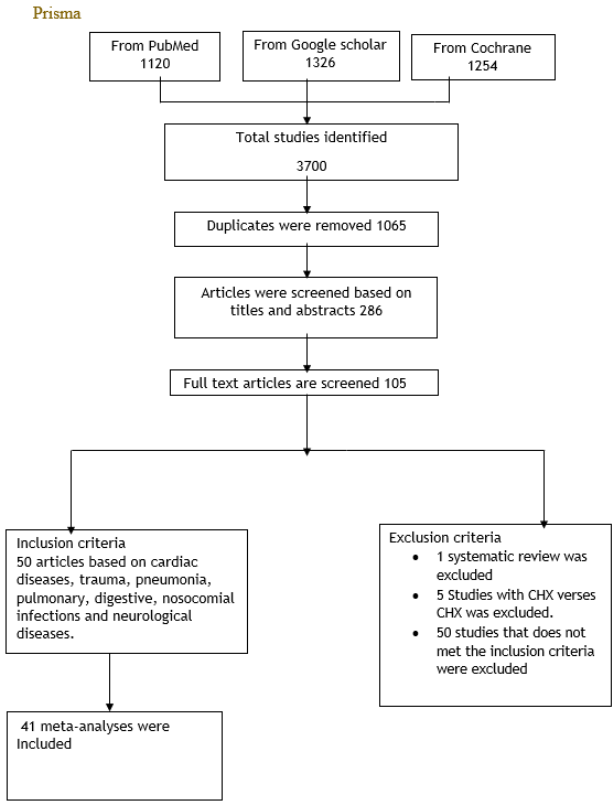
D.Data synthesis

Quantitative data will, where possible, be pooled in a random-effects meta-analysis model. All Effect sizes will be expressed as continuous and dichotomous data odds ratio or risk ratios for categorical data and the weighted mean difference, with 95% confidence intervals of the effect sizes will be estimated. All studies will be pooled to estimate an adjusted relative risk with 95% confidence intervals, irrespective of the study design used and the binary effect measure used. When statistical pooling is not possible, the findings will be presented in a narrative form, including tables and figures to aid in data presentation, where appropriate.

III. RESULTS

A.Study inclusion

A total of 3700 articles were identified by the search strategy of different databases like PubMed, Google scholar and Cochrane of which 2635 were removed based on duplicates, 286 articles were removed based the title and abstract. The full texts of 105 articles were screened, of which 50 articles met the inclusion criteria and were included in this review and 41 meta-analyses were included.



B.Methodological quality

Studies meeting the inclusion criteria were appraised for methodological quality. Based on the limited number of articles identified that met the inclusion criteria for this review and all studies were included, and any risk of bias was considered during data synthesis.

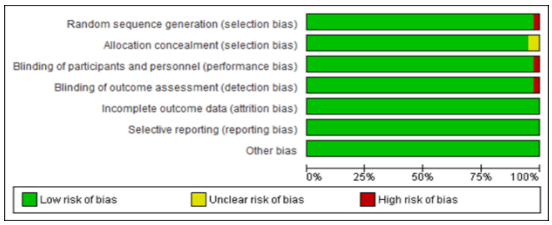


Figure. 1. Risk of bias Graph

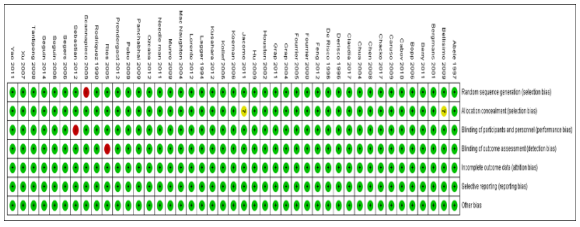


Figure. 2. Risk of bias Summary

C.Critical Appraisal:Characteristics of included studies

The 41 included studies in the review are Randomized control trail, observational, Retro prospective cohort studies, retrospective studies and prospective studies. Included studies explain about mortality studies on length of stay and other complications. These studies are appropriate for the study questions and the population being studied.

D.Review Findings: Incidence of VAP

The meta-analysis was conducted for those included studies for incidence of VAP and studies were compared with agents used for improved oral hygiene and usual care. The studies which are included in the review are randomized control trails. The main results of the meta-analysis comparing agents used for improved oral hygiene and usual care/placebo with antiseptics such as Chlorohexidine (CHX) Povidone, Saline, Tooth brushing and antibiotics (Iseganan) are summarized. Furthermore, subgroup analyses were conducted to explore the effects on the incidence of VAP.

Nine studies with CHX with three different concentrations 0.12%, 0.2% and 2% are compared with the usual care [4-12]. Ten studies were compared with CHX and not brushing/placebo[13,14,15,16,17,18,19,7,20, 21]. Four studies with Saline verses usual were compared [22, 23, 24, 25]. Ten studies were compared with CHX verses Placebo/ usual care [10, 4, 25,18, 27, 28, 24, 29 30, 31]. Four studies compared with povidone and placebo [25,26, 32, 33] Five studies with tooth brushing verses no tooth brushing/placebo [34, 5, 35, 36, 37]. Six studies were compared with antibiotics (Iseganan) verses placebo/ usual care [38, 39, 40, 41, 43, 44] and finally seven studies with other diseases associated like cardiothoracic and trauma were also compared [8, 9, 4, 10, 25, 12, 5].

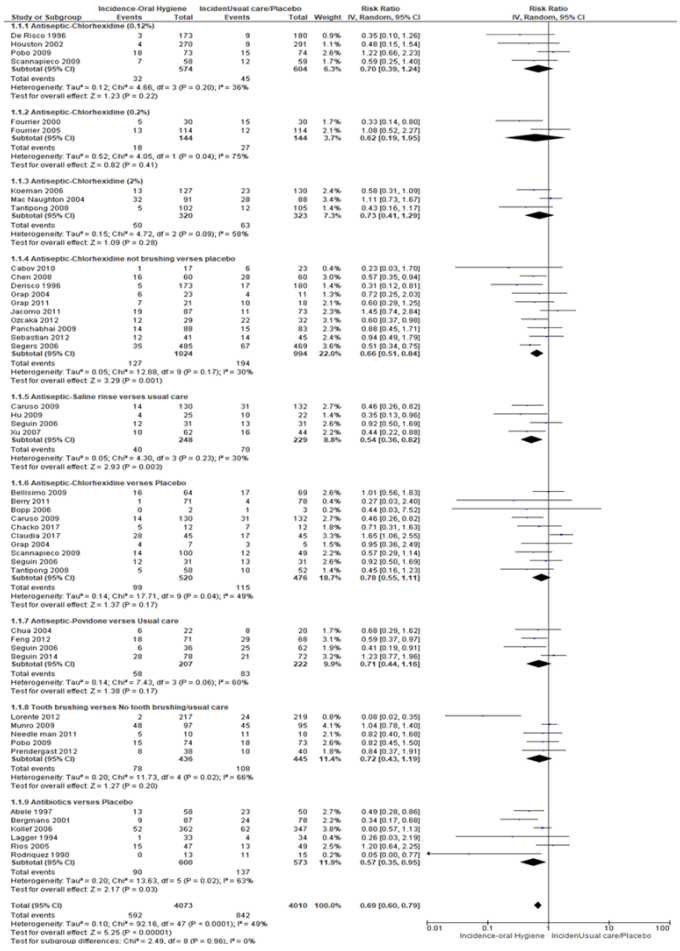


Figure. 3. Forest plot showing the incidence for agents for oral Hygiene and usual care

E.Mortality of VAP

The main results of the meta-analysis comparing agents used for improved oral hygiene and usual care/placebo with antiseptics such as Chlorohexidine (CHX) Povidone, Saline, Tooth brushing and antibiotics (Iseganan) are summarized. Furthermore, subgroup analyses were conducted to explore the effects on mortality of VAP. Eight studies with CHX and usual care[4, 5, 11, 13, 6, 12, 31, 45].

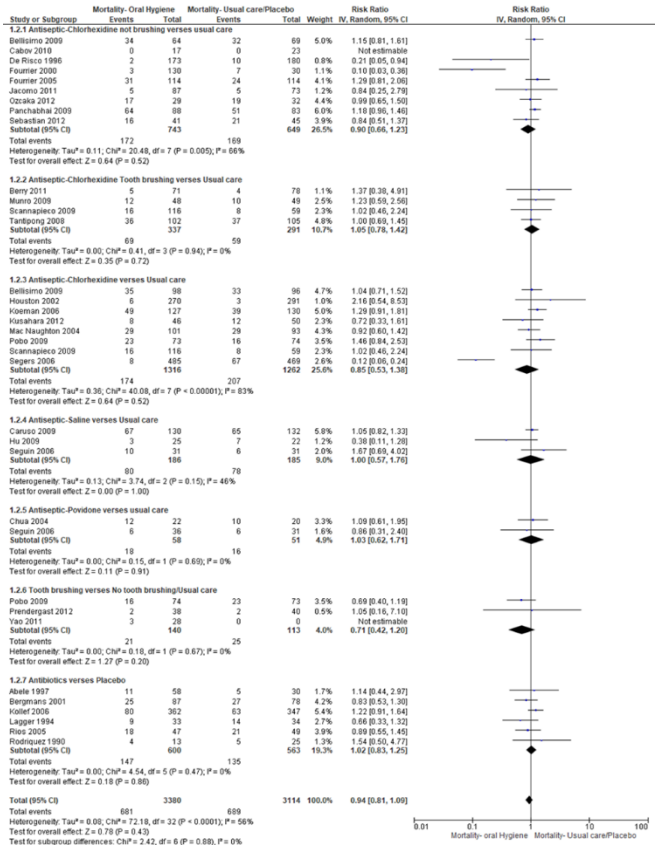


Figure. 4. Forest plot showing the mortality for agents for oral Hygiene and usual care

Nine studies were compared with CHX and not brushing/placebo [31, 21, 7, 8, 9, 14, 15, 16, 17]. Three studies with Saline verses usual were compared [23, 24, 25]. Nine studies were compared with CHX verses not brushing/usual care [31, 8, 9, 21, 7, 14, 15, 16, 17]. Two studies compared with povidone and placebo [25, 33] Three studies with tooth brushing verses no tooth brushing/placebo [34, 5, 46]. Six studies were compared with antibiotics (Iseganan) verses placebo/ usual care [39, 40, 41, 43, 44, 38, 42].

F.Length of hospital stay

The main results of the meta-analysis comparing agents used for improved oral hygiene and usual care/placebo with antiseptics such as Chlorohexidine (CHX) Povidone, Saline, Tooth brushing and antibiotics (Iseganan) are summarized. Furthermore, subgroup analyses were conducted to explore the effects on length of ICU stay for VAP. Three studies with tooth brushing verses no tooth brushing/placebo [37, 34, 5]. Six studies show antiseptics verses usual care [7, 8, 9, 12, 13, 25]. Two studies were included antibiotics verses usual care [40, 41, 42] Three studies were included for Chlorohexidine verses usual care/placebo [16, 31, 45].

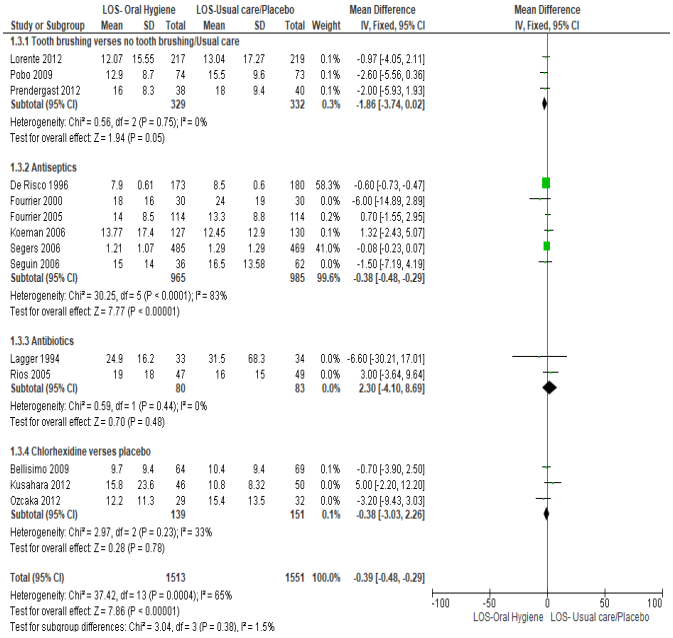


Figure. 5. Forest plot showing the Length of stay for agents for oral Hygiene and usual care

IV. DISCUSSION

VAP is the most frequently occurring nosocomial infection in the ICU and is associated with increased morbidity and mortality VAP is a main source of concern in critically ill patients. Most VAP is caused by microorganisms that are present in the oropharynx [48] and aspiration of pathogenic bacteria from the oropharynx is, therefore, the main pathophysiologic mechanism involved. According to some studies, respiratory pathogens isolated from the lung are often genetically indistinguishable from strains of the same species isolated from dental plaque and the tongue [49]. Therefore, it seems logical that improved oral care may reduce the risk of nosocomial respiratory infection. In this regard, some authors have investigated the utility of oral decontamination by the application of antibiotic or antiseptic agents. With respect to oral decontamination with chlorhexidine in critically ill patients, some studies have reported a reduction in positive dental plaque cultures [4, 9]. Standardized protocols which include the use of an antiseptic agent, can potentially reduce the risk for patients in acute care settings of developing VAP [49]. Thus, the CDC supports interventions to improve oral health, and subsequent reduction in the colonization of dental plaque with respiratory pathogens which may result in the development of VAP. Regular oral care with chlorhexidine is standard of practice for patients receiving mechanical ventilation in many hospitals. Our updated review of the evidence, however, suggests that caution is warranted. Although chlorhexidine does seem to protect against postoperative lower respiratory tract infections. chlorhexidine oral care may provide sufficient oral decontamination in patients but is inadequate to overcome the infectious hazard of an endotracheal tube. In the sub analysis of seven studies with 665 patients, the oral application of antiseptics (chlorhexidine 0.12–2%, povidone, saline and antibiotics) did significantly reduce the incidence of VAP However, reduction was found in the mortality and ICU stay with the oral application of antiseptics and antibiotics. Oral hygiene with antiseptics and antibiotics it might paradoxically decreasing the time of patients, resources, and organizational focus available for more robust interventions that are more likely to reduce incidence, decrease length of stay, and decrease mortality.

V. CONCLUSION

VAPCare is a promising new technology that has shown good safety and effectiveness in secretion clearance and oral hygiene management. By ensuring consistency and compliance to airway suctioning protocols, VAP Care can help reduce the risk of acquiring lung infection as well as improve ICU efficiency by reducing the staff time needed for manual suctioning. VAPCare is a safe system that did not cause any injury or side effects in the patient population, and also performed as intended. VAPCare effectively automates secretion clearance and oral lavage, and can bring consistency to this process, which is today entirely dependent on the nurses' skill and time availability. Nursing time saving is another potential benefit of VAPCare. Administration of antiseptics in different concentrations alongside the suction of oropharyngeal secretions and mechanical debridement gave good results in the lowering of the accumulation of the pathogens responsible for the VAP. The results obtained showed that, among patients undertaking antiseptics, antibiotics and toothbrushing there was a significant reduction in the incidence of VAP, mortality and length of ICU stay in ICU.

VI. LIMITATION

Although there is no published data on VAPcare, it needs to be investigated through further research.

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APPENDIX

Recent queries in PubMed		
Search	Query	Items found
#5	Search ((((endotracheal tube [MeSH Terms]) OR intubation) AND oral hygiene) [MeSH Terms]) OR (((((Oral care [MeSH Terms]) AND ((((usual care [MeSH Terms]) OR ((((Placebo [MeSH Terms])	943242
#4	Search (Endotracheal tube [MeSH Terms]) OR intubation	73672
#3	Search ((((((((((cardiac disease [MeSH Terms]) OR myocardial) OR cardiac arrest) AND pneumonia) OR bronchial pneumonia) AND neurologic) OR neurological) AND trauma) OR mental condition) OR psychological condition) AND digestive diseases AND nosocomial infections	35479
#2	Search ((((Adult [MeSH Terms]) OR person [MeSH Terms]) AND ventilator) OR breathing machine) OR mechanical ventilator	57251
#1	Search ((((adult [MeSH Terms]) OR person [MeSH Terms]) OR women) OR men) AND patient	1547154
APPENDIX 2 **Recent queries in Cochrane**		
Search	Query	Items found
1	((Adult) ti,ab,kw OR (person) ti,ab,kw AND (ventilator) ti,ab,kw OR (breathing machine) ti,ab,kw OR (mechanical ventilator)	11647
2	((cardiac disease) ti,ab,kw OR (myocardial) ti,ab,kw OR cardiac arrest) ti,ab,kw AND (pneumonia) ti,ab,kw OR (bronchial pneumonia) ti,ab,kw AND (neurologic) ti,ab,kw OR (neurological) ti,ab,kw AND (trauma) ti,ab,kw OR (mental condition) ti,ab,kw OR (psychological condition) AND (digestive diseases)ti,ab,kw AND (nosocomial infection)	37784
3	(endotracheal tube) ti,ab,kw OR (intubation) ti,ab,kw AND Oral Hygiene) ti,ab,kw AND (Usual care) ti,ab,kw OR (placebo)	3258

Google scholar search strategy: **1326**

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