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Oral hygiene with chlorhexidine and increase in time of hospitalization in an Intensive Care Unit

Implantação de uma rotina de cuidados em higiene oral e o tempo de internação em Unidade de Terapia Intensiva

Aplicación de una rutina de cuidados de higiene bucal y duración de la estancia en una Unidad de Cuidados Intensivos

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Objective: to evaluating the effect of an oral hygiene routine with chlorhexidine solution in the length of stay of intensive care patients, comparing the number of days of permanence in the intensive care unit before and after protocol implementation. **Methods:** this is a quasi-experimental study held in 2020, which analyzed 126 medical records, which were divided into two groups (63 each) according to the use of chlorhexidine 0.12% in an oral hygiene routine: before use (2004-2010) and after use (2011-2020). The selection of patients was based on pairing by sex, age, underlying disease and comorbidities. **Results:** the mean age was 55 years old (±18,76). The median length of stay before and after the new oral care routine were 3.0 and 5.0 days, respectively, and a significant increase in duration of hospitalization after routine implementation was observed (OR=2.82; CI95%=1.06-4.87; p=0.033). **Conclusion:** after implementing the oral hygiene routine using a chlorhexidine, the length of stay of patients in the intensive care unit significantly increased.
Descriptors: Chlorhexidine; Dental staff; Intensive care units.

Objetivo: avaliar o efeito de uma rotina de higiene oral com solução de clorexidina no tempo de internação de pacientes em Terapia Intensiva, comparando o número de dias de permanência na Unidade de Terapia Intensiva antes e após a implantação do protocolo. **Método**: trata-se de um estudo quase-experimental realizado em 2020, que analisou 126 prontuários, os quais foram divididos em dois grupos (63 cada) de acordo com o uso de clorexidina 0,12% em uma rotina de higiene bucal: antes do uso (2004-2010) e após o uso (2011-2020). A seleção dos pacientes foi pareada por sexo, idade, doença de base e comorbidades. **Resultados**: a média de idade foi de 55 anos (±18,76). A mediana do tempo de internação antes e após a nova rotina de higiene bucal foi de 3,0 e 5,0 dias, respectivamente, e observou-se aumento significativo no tempo de internação após a implantação da rotina (OR=2,82; IC95%=1,06-4,87; p=0,033). **Conclusão**: após a implementação da rotina de higiene bucal com clorexidina, o tempo de permanência dos pacientes na unidade de terapia intensiva aumentou significativamente.
Descritores: Clorexidina; Equipe hospitalar de odontologia; Unidades de terapia intensiva.

Objetivo: evaluar el efecto de una rutina de higiene bucal con solución de clorhexidina en el tiempo de internación de pacientes en Cuidados Intensivos, comparando el número de días de estancia en la Unidad de Cuidados Intensivos antes y después de la implantación del protocolo. **Método:** se trata de un estudio cuasiexperimental realizado en 2020, en el que se analizaron 126 historias clínicas, que se dividieron en dos grupos (63 cada uno) según el uso de clorhexidina al 0,12% en una rutina de higiene bucal: antes del uso (2004-2010) y después del uso (2011-2020). La selección de pacientes se emparejó por sexo, edad, enfermedad subyacente y comorbilidades. **Resultados:** la edad media fue de 55 años (±18,76). La mediana de la duración de la estancia antes y después de la nueva rutina de higiene bucal fue de 3,0 y 5,0 días, respectivamente, y se observó un aumento significativo de la duración de la estancia tras la implantación de la rutina (OR=2,82; IC 95%=1,06-4,87; p=0,033). **Conclusión:** tras la implantación de la rutina de higiene bucal con clorhexidina, la duración de la estancia de los pacientes en la unidad de cuidados intensivos aumentó significativamente.
Descriptores: Clorhexidina; Personal de odontología en hospital; Unidades de cuidados intensivos.

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INTRODUCTION

Hospitalized patients can be affected by buccal alterations if they do not receive proper oral hygiene while in hospital[1]. Biofilm accumulation as a consequence of poor or completely absent oral hygiene practices is one of the main causes of respiratory complications associated to mechanical ventilation, since high concentrations of pathogens are found in the saliva and may undergo bronchoaspiration, leading to pulmonary infections[2].

Also, during a hospitalization, the low salivary flow, as well as reduced coughing reflexes, little possibility of self-cleaning and physical disabilities contribute to the development of opportunistic infections[2-3]. Moreover, there are evidences that poor oral health conditions are related to the decompensation of chronic systemic diseases with degenerative potential, such as diabetes mellitus (DM), cardiovascular diseases, kidney diseases and rheumatoid arthritis, emphasizing the unfavorable and detrimental effects they may produce in the patient's general health status[4].

In an attempt to avoid possible complications, oral hygiene practices should be performed periodically, since health care management enhances the rate of medical discharges and reduces in-hospital mortality[5]. Therefore, the members of the multi-professional team (dental surgeons, physicians, physical therapists, speech therapists and nurses) must interact with each other, in an educational and informative manner[6].

Each hospital service, under the guidance of a dental surgeon (DS), must elaborate and implement an oral hygiene protocol according to the profile of the patients who are being cared for in the ICU, in consonance with the Hospital Infection Control Committee (HICC) and the nursing staff[2,6]. The nursing staff should be responsible for performing the established protocol and the DS should be in charge of training these professionals[3].

According to a Brazilian study, the median length of intensive care unit (ICU) stays for patients after surgery is 2 (1-4) days. Patients who develop secondary infections have an exacerbation of their general health condition and require more time to be discharged, consequently affecting the bed turnover and intensifying the shortage of vacant ICU beds[7].

The implementation of chlorhexidine-based oral care protocols aiming to prevent respiratory infections in severely-ill patients has been widely adopted, in spite of controversies regarding its efficacy and risk of increased in-hospital mortality[8-10]. Even in the face of these evidences, the pathogenic mechanisms that support this association are yet poorly understood due to the scarcity of studies and lack of accurate records concerning related adverse reactions[8]. One study has suggested that the aspiration of this antiseptic by inpatients may lead

to acute pulmonary lesions and acute respiratory distress syndrome (ARDS)[9]. In another study, the oral mucositis is the main association pathway between exposure to chlorhexidine and increase in in-hospital mortality rates[11]. The loss of integrity of the oral mucosa possibly allows bacterial translocation from the oral cavity to the bloodstream, increasing the probability of infection and sepsis. For that reason, in-depth investigations concerning the implementation of chlorhexidine-based oral hygiene protocols are deemed justifiable.

The present study aimed to evaluating the effect of an oral hygiene (OH) routine with chlorhexidine solution in the length of stay of intensive care patients, comparing the number of days of permanence in the Intensive Care Unit (ICU) before and after protocol implementation.

METHODS

This is a quasi-experimental study based on the hypothetical-deductive method and with performance of comparative analysis, from data obtained from indirect observation of secondary information contained in medical records.

The study was performed in a post-surgical ICU of the São Vicente de Paulo Hospital (HSVP) in João Pessoa, in the state of Paraíba (PB), Brazil. This ICU has 12 beds and two multi-professional teams that provide health care to inpatients.

In previous years to 2011 there was no oral hygiene routine. In 2011,a new routine of oral hygiene was implemented that included: Cleaning of the oral cavity with 0,12% chlorhexidine (using sterilized gauze pads wrapped around a wooden tongue depressor) without aspiration, and lip moisturizing with oils containing essential fatty acids (EFA) in unconscious patients. The same protocol was performed in conscious patients. This routine was performed once a day, from Monday to Friday.

Sample size was calculated based on a hypothesis of difference, considering a type I error (α) of 5% (two-tailed) and a type II error (β) of 20%, leading to a statistical power of 80% and Cohen's H effect size of 0,5 (mean) since there are no previous studies that evaluate this information. As a result, the sample was estimated in 63 medical charts per group, randomly selected per year, comprising a total of 126 charts.

The sample selection to compose each of study group (before and after OH with chlorhexidine) was performed from medical records of patients admitted in the ICU before oral hygiene routine with chlorhexidine solution (from 2004 to 2010) (G1) and the after oral hygiene routine with chlorhexidine solution (from 2011 to 2020) (G2).

The inclusion criteria were the correctly filled medical records, with information concerning each patient's length of stay. Medical records of patients who died during their stay

in the ICU and those missing any important information for the development of this research were excluded.

The individuals selected initially in the first period (before oral hygiene routine with chlorhexidine solution) were paired by age with the individuals evaluated before the implementation of this routine, being selected 63 individuals to composed each of group of study.

The data were extracted from the selected records and registered in a specific data collection built by the researchers of this study, between March and October 2020. The variables of interest were: age, sex, type of illness, associated comorbidities, type of ventilation and length of hospitalization.

The data were inserted in an IBM SPSS software platform (25.0, IBM Corporation, Armonk, New York, USA) and descriptive and inferential statistical analysis were performed (Kolmogorov-Smirnov test; Student's T-test; Pearson's chi-square test; Pearson's chi-square test with Yates's correction; Mann-Whitney U test). Regression models were used to analyze the outcome "length of stay" in different situations. The length of stay before and after the implementation of the oral care routine was assessed by a linear model, while a binary model was used considering two categories: one to 5 days of stay (reference) and more than 5 days of stay. A level of significance of 5% was set for all tests.

This study was conducted in accordance with the Brazilian Health Council guidelines that regulate research involving humans (Resolution No 466/12) and was approved by the Research Ethics Committee (protocol No 3.934.490) of the Instituto de Educação Superior da Paraíba (UNIESP).

RESULTS

63 patients were considered to each group (G1 and G2). The mean age of patients before and after oral hygiene routine with chlorhexidine was of 52.76 and 57.43, respectively. In G1, males were more prevalent (60.30%) and in G2, females were more prevalent (57.10%), although no differences were found between the periods for sex distributions ($p>0.05$) (Table 1).

Cardiovascular and neoplastic diseases were the most prevalent types of illness, as in G1 as in G2, being even more prevalent in G2. Gastric, neurological, kidney and liver illness were more prevalent in G1 (Table 1).

The invasive ventilation was more prevalent in G1, but the type of ventilation did not vary significantly between groups ($p>0.05$) (Table 1).

The median lengths of stay of patients from before and after the implementation were 3 and 5 days, respectively, and this difference was statistically significant (p=0.01; Mann-Whitney U test) (Table 1).

Table 1. Sample characterization according to the moment of admission, before and after the arrival of a DS to the multi-professional team. João Pessoa-PB, Brazil, 2020.

Variables	Categories	G1 (No=63)	G2 (No=63)	p
Age mean (±SD)	-	52.76 (±19.15)	57.43 (±18.21)	0.16 [a]
Sex	Male	38 (60.30%)	27 (42.90%)	0.07 [b]
	Female	25 (39.70%)	36 (57.10%)	
Type of illness	Cardiovascular	20 (31.70%)	31 (49.20%)	0.03 [c]
	Neoplastic	17 (27.00%)	23 (36.50%)	
	Gastric	08 (12.70%)	04 (6.30%)	
	Neurological	09 (14.30%)	03 (4.80%)	
	Kidney	03 (4.80%)	01 (1.60%)	
	Liver	03 (4.80%)	00 (0.00%)	
	Other	03 (4.80%)	01 (1.60%)	
Ventilation	IMV	20 (31.70%)	13 (20.60%)	0.15 [b]
	NIMV	18 (28.60%)	28 (44.40%)	
	NB	25 (39.70%)	22 (34.90%)	
Length of stay (days) Median (P25; P75)	-	3.00 (2.00; 6.00)	5.00 (2.00; 7.00)	0.01 [d]
Comorbidities	Without comorbidities	45 (71.30%)	30 (47.60%)	0.02 [c]
	SAH + DM	-	07 (11.10%)	
	SAH	08 (12.70%)	06 (9.50%)	
	DM	04 (6.40%)	04 (6.30%)	
	Others*	06 (9.60%)	16 (25.50%)	
Length of stay	1 a 5 dias	47 (74.60%)	35 (55.60%)	0.03 [b]
	Mais de 5 dias	16 (25.40%)	28 (44.40%)	

G1 = Before oral hygiene with chlorhexidine; G2 = After oral hygiene with chlorhexidine; IMV = Invasive Mechanical Ventilation; NIV = Non-invasive Mechanical Ventilation; NB = Normal Breathing; SAH = Systemic arterial hypertension; DM = Diabetes Mellitus. [a] Student's T-test; [b] Pearson's chi-square test; [c] Pearson's chi-square test with Yates's correction; [d] Mann-Whitney U test. Level of significance=5%; *Otheres= Sepsis, hypovolemic shock, CSF fistula, stroke, heart disease, presence of myiasis, septic shock, liver cirrhosis, chronic renal failure, tracheosophageal fistula, Alzheimer, rheumatoid arthritis, seizures, Parkinson's, pneumonia, acute respiratory failure, liver disease, alcoholism, metabolic acidosis; - = absent data.

Systemic arterial hypertension (SAH) was the most prevalent comorbidity (12.70%, No=8) in G1, while the association between SAH and Diabetes Mellitus (DM) was the main comorbidity (11.10%, No=7) observed in G2.

A difference in the distribution of comorbidities was observed between G1 and G2 (p=0.02; Pearson's chi=square test with Yates's correction) since the number of patients. In G1, forty-five patients (71.40%) presented comorbidities; and, in G2, 30 patients (47.60%) had comorbidities.

According to the binary regression model for length of stay (one to 5 days or more than 5 days), it was observed that the chance of a patient staying longer than 5 days in the ICU was 2.82 times higher (CI95%=1.06-4.87; p=0.03) after the oral care routine implementation when compared to the period of absence of oral hygiene practices. Also, in regard to the linear

regression model, it was observed that the presence of comorbidities influenced the increase in length of stay for both groups and that the variable "sex" influenced the length of stay in the "after the implementation" group (Table 2).

Table 2. Results for the final adjusted linear regression model for the outcome "length of stay" in each of the studied groups. João Pessoa-PB, Brazil, 2020.

Group	Variable	p-value	B	Error	R^2
G1	Intercept	<0.01	3.23	3.47	9.00%
	Number of patients with comorbidities	0.02	0.24		
G2	Intercept	<0.01	6.84	3.44	23.20%
	Male sex	0.03	-1.99		
	Number of patients with comorbidities	<0.01	0.20		

DISCUSSION

The importance of adequate oral hygiene protocols and biofilm disruption is widely known and recommended, since oral health management with biofilm removal and the performance of dental procedures reduces the occurrence of respiratory tract infections and, with that, hospitalization costs [3].

In this study, the scenario found was not the expected: an increase in length of stay of ICU patients was observed after the implementation of an oral hygiene protocol. The linear regression model demonstrated that the chlorhexidine-based protocol increased the chance of a patient staying in the ICU for more than five days. Other studies that evaluated the relation between chlorhexidine and time of permanence in the ICU did not demonstrate significant reduction in length of stay[12-13].

Moreover, it was observed that dental procedures, such as retained root removal and non-surgical periodontal treatment, were not performed. This data can be inferred by the mouth alterations found in patients and also the absence of records regarding this matter. On the other hand, the resolution of coated tongue cases through oral cavity cleaning with 0.12% chlorhexidine was reported by the DS.

A randomized clinical trial demonstrated that the combination of dental procedures and oral cavity cleaning with chlorhexidine 0.12% in intensive care patients prevents more cases of respiratory tract infection than the cleaning with this antiseptic alone[3]. However, several oral hygiene methods using chlorhexidine in different concentrations as well as associated with different biofilm removal techniques are proposed in the literature[14].

Chlorhexidine digluconate is a dicationic compound which acts upon gram-positive and gram-negative bacteria, fungi, yeasts and lipophilic viruses[15]. Its mechanism of action consists in adsorption to the microorganism's membrane due to electrostatic interaction, generating an initial antibacterial effect. Also, its substantivity promotes a bacteriostatic response due to

active permanence in the oral cavity for approximately 12 hours[15]. A study demonstrated that, due to the compound's substantivity, using 0.12% chlorhexidine for oral hygiene twice a day was an effective strategy for controlling and reducing biofilm formation as well as the occurrence of ventilator-associated pneumonia (VAP) in intensive care patients[16]. This frequency of chlorhexidine-based cleaning is in consonance with the Standard Operational Protocol (SOP) determined by the Brazilian Intensive Care Medicine Association (AMIB)[17].

After evaluating all records regarding the oral condition and evolution of each patient, it was observed that oral cleaning with chlorhexidine 0.12% was performed only once a day, from Monday to Friday. A study concerning dental practices and procedures in Brazilian ICUs showed that most of the facilities performed their oral care protocol three times a day (35%)[18] and chlorhexidine 0.12% - 0.20% was the antiseptic of choice in 80.8% of them. Nevertheless, there is no agreement in the literature towards oral hygiene protocols for ICU patients, neither concerning their frequency nor the antiseptic substances to be adopted.

The use of chlorhexidine 0.12% is not a synonym of proper cleaning. Both authors suggest this antiseptic for critically compromised inpatients and those with poor oral hygiene, which would justify the need for this substance's mechanical biofilm disruption properties. Patients with good oral condition would therefore not need this intervention and could even develop adverse reactions[19-20].

In the same framework, another paper appeals to the scientific community, emphasizing the need for studies that clarify the real need for the use of chlorhexidine rinsing solutions in ICU patients[20]. In addition to the adverse effects reported in other studies, such as mucosal reactions, bacterial resistance and risk of death, they add that the patient should be assessed individually and chlorhexidine-based interventions should be carried out carefully, only if the patient really needs them. They also defend the planning of more cost-effective protocols aimed at reducing hospital costs, and stand by the idea that oral care should be thought as a basic hygiene matter rather than just a preventive measure for VAP.

The use of other strategies to prevent and/or reduce the risks of endogenous and exogenous infections, such as selective digestive decontamination (SDD) and selective oropharyngeal decontamination (SOD), is more effective than the topical application of chlorhexidine, contributing to the reduction of in-hospital mortality rates[10]. Furthermore, the results of the described meta-analyses demonstrated an association between the use of chlorhexidine and increased mortality in intensive care patients, raising questions about its safety and efficacy.

Other authors have confirmed this perception and emphasized the need for careful consideration regarding the indiscriminate and unrestricted use of chlorhexidine since its evidence-based benefits are still insufficient[8]. All things considered, new clinical trials are encouraged so that evidence-based and cost-effective protocols may be proposed, offering minimal risk for patients and being able to exert satisfactory biofilm control.

Another important result found in our study was the increase of chronic non-transmissible diseases (CNTDs) through the years, with higher frequency after the integration of a DS in the multi-professional team (p=0.038). CNTDs include cardiovascular disorders, diabetes, neoplastic and chronic respiratory diseases, comprising the major causes of morbimortality worldwide and being responsible for 63% of deaths globally[21] as well as 72% of deaths in Brazil[22]. Furthermore, data from the Brazilian Health Survey showed that more than 45% of the adult population reports bearing at least one CNTD[23]. The CNTDs have arisen due to changes in people's dietary, living and work-related habits. Such changes occurred due to economic and social aspects as well as population ageing[24].

The most common CNTDs observed in our study were cardiovascular and neoplastic diseases. Cardiovascular disorders are the major cause of death worldwide[25], as well as in Brazil[23], where it is the cause of approximately one-third of all deaths. In order to provide a regional perspective, one study compared the mortality by cardiovascular diseases in all five Brazilian regions[26]. They came to the conclusion that the Northern, Northeastern and Central-Western regions presented higher rates when compared to the South and Southeastern regions. It should be mentioned that the hospital costs due to cardiovascular diseases are greater than those related to other causes of hospitalization[27]. Neoplastic diseases, on the other hand, are the second major cause of death in most countries and showcases an ascending tendency[25].

In regard to mechanical ventilation demands, most of the patients showed the need for NIMV. The administration of NIMV for patients with respiratory failure is an alternative to intubation. Its level of success takes into consideration the patient's clinical conditions and matters such as choice of interface, ventilation mode, patient-ventilator interaction, careful monitoring of objective signals and the patient's comfort and tolerance[28].

The systemic comorbidities identified in this study were SAH, which was the most prevalent, followed by DM and the association of both. These findings corroborate with those from a study conducted in the ICUs of the Hospital Geral Universitário (HGU) of Cuiabá, in the state of Mato Grosso (MT) [29]. SAH is an increasing populational reality and may provoke serious health impairments such as myocardial, kidney, cerebral and peripheral vascular ischemia. Also, it is one of the major causes of deaths in Brazil[30].

CONCLUSION

This study had some limitations, such as lack of information in specific years and absence of some daily records that should have been provided by the on-call doctor, DS and the nursing staff. However, these are inherent to secondary research methodologies and did not compromise the observed results since bias control strategies were applied.

Studies similar to this reveal the effectiveness of health care professionals in the face of typical work demands as well as the contributing variables related to the duration of hospitalization, and encourage the elaboration of strategies focused on improving these matters. Our results reinforce the replication of this methodology in other facilities, focusing on the enrichment of literature concerning the development of adequate oral hygiene and biofilm disruption protocols in intensive care units. The identification of results contrary to the expected ones calls for the creation of health policies that aim to reduce the patient's time of permanence in the hospital as well as hospital costs.

Therefore, our study supports the creation and implementation of a suitable oral hygiene protocol in the ICU and highlights the importance of including a dental surgeon in the multi-professional team. It also encourages the performance of dental procedures, proper training of the nursing staff for oral health management and the acquisition of new members for the health care team since a single performance of the chlorhexidine-based routine five days a week was not effective in reducing the patients' length of stay. It observe after the implementation of oral hygiene routine with solution of chlorhexidine, the time of hospitalization of patients in ICU significantly increased.

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