

EVALUATION OF THE IMPLEMENTATION OF NEW PROTOCOL OF ORAL HYGIENE IN AN INTENSIVE CARE CENTER FOR PREVENTION OF PNEUMONIA ASSOCIATED WITH MECHANICAL VENTILATION

AVALIAÇÃO DA IMPLEMENTAÇÃO DE NOVO PROTOCOLO DE HIGIENE BUCAL EM UM CENTRO DE TERAPIA INTENSIVA PARA PREVENÇÃO DE PNEUMONIA ASSOCIADA À VENTILAÇÃO MECÂNICA

EVALUACIÓN DE LA APLICACIÓN DEL NUEVO PROTOCOLO DE HIGIENE BUCAL EN UN CENTRO DE CUIDADOS INTENSIVOS PARA LA PREVENCIÓN DE LA NEUMONÍA ASOCIADA A VENTILACIÓN MECÁNICA

Alessandra Figueiredo de Souza ¹
Aneliza Cecon Guimarães ²
Efigênia Ferreira e Ferreira ³

¹RN. Specialist in Microbiology. Internship Resident, Hospital das Clínicas of Universidade Federal de Minas Gerais – UFMG. Belo Horizonte, MG – Brazil.

² Internship Resident of Hospital das Clínicas of UFMG. Belo Horizonte, MG – Brazil.

³ Associate Professor, Faculty of Dentistry of UFMG. Belo Horizonte, MG – Brazil.

Corresponding Author: Alessandra Figueiredo de Souza. E-mail: alessandrafigs@yahoo.com.br

Submitted: 02/16/2012

Approved: 11/07/2012

ABSTRACT

Ventilator-associated pneumonia (VAP) is one of the most prevalent infections in the intensive care unit (ICU). Among the risk factors we can highlight microaspiration of oropharyngeal microorganisms. A strategy for prevention of VAP was created by means of a ventilation bundle. However, not all strategies are included in the bundle, for example, oral hygiene. This study aimed to assess the importance of oral hygiene procedures in preventing VAP. We conducted a review of secondary data from the infection control committee of a hospital between 2008-2011 to assess the frequency of these occurrences. We also evaluated the perception of health practitioners in the ICU on the implementation of the oral hygiene protocol. A questionnaire was administered upon signature of the informed consent. Pneumonia was the primary cause of infection in the ICU from 2008 to 2010. In 2011, after deploying the bundle, pneumonia was no longer the most frequent. Reduction in pneumonia cases from after introducing the bundle to the incorporation of the oral hygiene protocol ranged from 33.3% to 3.5%. With regards to how practitioners perceive the presence of dentists in the ICU, 56 respondents cited oral hygiene as the second most important measure introduced. All practitioners said to they were favorable to the inclusion of dentists in the ICU. The vast literature available demonstrates the efficiency of the oral hygiene protocol in preventing VAP, so inclusion of this measure in the bundle is highly recommended.

Keywords: Ventilator-Associated Pneumonia; Oral Hygiene; Chlorhexidine.

RESUMO

A pneumonia associada à ventilação mecânica (PAVM) é uma das infecções hospitalares mais prevalentes na Unidade de Tratamento Intensivo (UTI). Dentre os fatores de risco, destacam-se as microaspirações de microrganismos da orofaringe. A estratégia para prevenção da PAVM foi a criação do bundle da ventilação. Nem todas as estratégias, porém, estão incluídas no bundle – por exemplo, a higiene bucal. O objetivo com este trabalho foi avaliar os procedimentos de higiene bucal na prevenção da PAVM. Foram avaliados os dados secundários da comissão de controle de infecção hospitalar entre 2008 e 2011, apresentados por frequência de ocorrência, bem como a percepção dos profissionais de saúde na UTI sobre a implantação do protocolo de higiene bucal. Após assinar o Termo de Consentimento Livre e Esclarecido (TCLE), foi aplicado um questionário. A pneumonia foi a principal causa de infecção no CTI, de 2008 a 2010. Em 2011, após a implantação do bundle, a pneumonia deixou de liderar como a mais frequente. Em números percentuais, a redução de pneumonia após a implantação do bundle até a incorporação do protocolo de higiene bucal variou de 33,3% para 3,5%. Sobre a percepção dos profissionais sobre a inserção da odontologia na UTI, 56 profissionais responderam ao questionário, citando a higiene bucal como a segunda medida mais importante. Cem por cento dos profissionais responderam que eram favoráveis à inserção do dentista na UTI. A vasta literatura existente evidencia a eficiência do protocolo de higiene bucal na prevenção de PAVM. Recomenda-se, portanto, a inserção dessa medida no bundle.

Palavras-chave: Pneumonia Associada à Ventilação Mecânica; Higiene Bucal; Clorexidina.

RESUMEN

La neumonía asociada a ventilación mecánica (NAV) es una de las infecciones más prevalentes en unidades de cuidados intensivos (UCI). Entre los factores de riesgo se destacan la microaspiración de bacterias colonizantes de la orofaringe. La estrategia para prevención de la NAV fue la creación del bundle de la ventilación. Sin embargo, no todas las estrategias se incluyen en el paquete de medidas como, por ejemplo, la higiene bucal. Este estudio tuvo como objetivo

evaluar los procedimientos de higiene oral para prevenir la NAVM. Se realizó una revisión de datos secundarios de la comisión de control de infecciones del hospital entre 2008 a 2011 según la frecuencia de incidencia. También se evaluó la percepción de los profesionales de la salud en la UCI sobre la aplicación del protocolo de higiene bucal. Después de firmar el consentimiento informado se aplicó un cuestionario. La neumonía fue la principal causa de infecciones en la UCI desde 2008 hasta 2010. En 2011, después de implementar el paquete, la neumonía dejó de ser la más frecuente. En porcentaje, la reducción de la neumonía después de la puesta en práctica del bundle hasta la incorporación del protocolo de higiene bucal varió entre 33,3% y 3,5%. Acerca de la percepción de los profesionales de la inserción de la odontología en la UCI, 56 profesionales encuestados citaron la higiene bucal como la segunda medida más importante. El cien por ciento de los profesionales es favorable a la inclusión del dentista en la UCI. La vasta literatura demuestra la eficacia del protocolo de higiene bucal en la prevención de la NAVM. Se recomienda, entonces, la inclusión de esta medida en el paquete.

Palabras clave: Neumonía Asociada ao Ventilador; Higiene Bucal; Clorhexidina.

INTRODUCTION

Advances in scientific research in healthcare reveal a new paradigm that reinforces the interrelation of mouth diseases (especially periodontal) with other systemic diseases, making effective treatments available for doctors and dental surgeons. Periodontal medicine correlates this disease to systemic conditions, such as atherosclerosis, acute myocardial heart attack, pre-term births with low weight at birth, and, most importantly, respiratory problems.¹

Ventilator-associated pneumonia (VAP) is one of the most prevalent hospital-acquired infections in intensive care units (ICU), with rates that range from 9% to 40%, and is associated to an increase in hospital stay and morbimortality rates, significantly influencing costs.²⁻¹⁰ Pneumonia remains one of the leading causes of death in the world, among the five most frequent in people over the age of 65 in the United States.¹¹ Mortality rates of these infections can range from 24% to 76%, especially when pneumonia is associated to *Pseudomonas spp.* or *Acinetobacter spp.* Patients under mechanical ventilation in ICUs have 2 to 10 times greater risk of death than patients without ventilation, resulting in longer hospital stay, from 4 to 9 days in average.¹³

VAP develops 48-72 hours after the onset of mechanical ventilation (MV), and is possible up to 48 hours after extubation.² VAP is classified as either early (up to the 4th day of intubation and beginning of MV) or late (after the 5th day of intubation and MV).¹²

According to the Center for Disease Control (CDC), VAP is a nosocomial lung infection that occurs in patients under MV, for whom the infection is not the reason for ventilatory support. VAP diagnosis is based on the combination of radiological, clinical, and laboratorial criteria. Pneumonia is considered to be associated to MV during or in the 48 hours before the onset of infection.¹⁴

The main risk factors for the development of nosocomial pneumonias are: age over 70 years, malnutrition, underlying diseases, low levels of consciousness, lung and heart diseases, use of probes, enteral nutritional support, patient position and insufficient head elevation, mechanical ventilation, intubation (presence of orotracheal tube) or orotracheal reintubation, tra-

cheostomy, macro or microaspiration of tracheobronchial secretion, previous use of antimicrobial agents, bronchoscopy, and bronchoaspiration of oropharyngeal microorganisms.¹²

Additionally, some of the risk factors above, such as enteral nutritional support, patient position and insufficient head elevation, orotracheal tube, and mechanical ventilation can increase the risk of pneumonia in 6 to 21 times.¹²

The CDC considers, in addition to microaspiration of oropharyngeal microorganisms, the inhalation of aerosols that contain bacteria, the hematogenic transmission to other body parts, and bacterial translocation of the gastrointestinal tract.¹⁴

The mouth is under constant colonization, and the bacterial plaque is a permanent supply of microorganisms.¹² There have been several reports associating microbial colonization of the oropharynx and dental plaque with VAP.¹⁵⁻¹⁹

Studies show a high colonization of respiratory pathogens in the mouth biofilm of patients in ICUs, with 70% of microorganisms found in the biofilm, and 63.33% on the tongue.¹⁶

Precarious oral hygiene and factors such as a decrease in the natural cleaning process of the mouth by mastication of hard and fibrous food, tongue and cheek movement during speech, and decrease in saliva flow due to certain medications contribute to augmented biofilm. Long hospitalizations also lead to mouth colonization by respiratory pathogens with higher resistance to antimicrobials.^{18,12}

These patients seldom have an adequate oral hygiene, possibly because a coordination between dentistry and nursing staff is absent, as well as because of inadequate oral hygiene techniques by the ICU team, all of which favor the colonization of the oropharynx.²⁰ The reasons given for the inadequate oral hygiene in ICU patients by the acting health team are: absence of a dentistry practitioner in the ICU, lack of knowledge of odontological pathologies and procedures, time constraints, and the patients' physical limitations.²¹

Chlorhexidine was used for the first time in dentistry in 1959. The first reports on its impact in controlling dental plaque were presented in 1969 and 1970 by Löe and Schiödt.²²

The aqueous solution of chlorhexidine has a broad spectrum of microbicidal action, acting on gram-positive and gram-

negative bacteria, fungi, yeast, and lipophilic viruses.^{23,24} It has a substantivity of 12 hours.²³ It is commonly used in aqueous solution of 0.12% twice a day,²³⁻²⁵ and is authorized by the Food and Drug Administration (FDA).²⁶ A chlorhexidine solution reduces 80-90% of microorganisms in saliva and inhibits the growth of yeast and enteral bacteria.²⁶

After use of chlorhexidine in patients for a period of 2 years, there was no change or redistribution of the salivary microbial population.²⁶ Until now chlorhexidine has shown low systemic toxicity in humans, no verifiable resistance to mouth microorganisms, and has not been associated to teratogenic alterations.²⁶ According to toxicological reports, chlorhexidine is almost completely eliminated fecally, and the minimal quantity absorbed by the gastrointestinal tract is eliminated by the kidneys and liver.²⁶

A protocol was devised to prevent VAP, named the ventilation bundle, that when implemented for all patients under MV results in a significant decrease in the incidence of the disease.²⁷

The prevention bundle has four main components: elevation of the head end of the bed to around 30 to 45 degrees; daily interruption of sedation and assessment of extubation conditions; prophylaxis of peptic ulcer; and prophylaxis of deep-vein thrombosis (DVT) (unless not recommended).²⁷

Not all therapeutic strategies are included in the bundle – for instance, oral hygiene. In choosing which interventions to adopt, a series of factors must be considered, such as cost, ease of implementation, and proven adherence to the most basic preventive measures in the first place.²⁷

The efficacy of oral hygiene and control of the mouth biofilm in preventing nosocomial pneumonias has been reported in several studies.^{1-7,28-30} For this reason, the Brazilian Health Surveillance Agency (Anvisa, in Portuguese) recommends, in the Board Resolution RDC number 7, dated February 24, 2010,³¹ which describes the minimal requirements for operating ICUs, that every patient receive integral and interdisciplinary assistance. Among these, the pharmaceutical, psychological, phonaudiological, social, and nutritional assistances as well as enteral/parenteral nutritional therapy, occupational, and odontological therapy ought to be integrated to patient care, and discussed by the multidisciplinary team.

Prevention of pneumonia associated to MV is justified by its impact, since it is considered the leading cause of death among nosocomial infections, leading to longer periods under MV and permanence in the ICU. Its prevention would result in shorter hospitalizations after ICU release, and therefore lower costs.^{3,4,6-8, 27}

The aim of this study was to assess oral hygiene procedures associated with a chemical agent in the prevention of VAP in the ICU of a hospital belonging to the public health system in Belo Horizonte, Brazil.

METHODOLOGY

The institution in which the study was carried out is a public hospital linked to the Federal University of Minas Gerais (UFMG), which plays an important role in the expansion and improvement of teaching and research.³²

The insertion of a dentistry team in the intensive care center (ICC) in this hospital took place in April 2010, through a program of multidisciplinary residence with emphasis on geriatric health.

Among the first activities performed by the dentists in the ICC was a survey of oral mucosa lesions and oral hygiene of all patients in that sector. This led to adapting the oral hygiene protocol adopted by the institution. The new protocol was based on that developed by Souza et al.³³ In addition to refinements in the methods of oral hygiene, the solution used previously (cetylpyridinium chloride, 0.05%) was replaced with chlorhexidine (0.12%) for odontological use. After the hospital and the Commission of Hospital Infection Control (CCIH, in Portuguese) approved by the use of chlorhexidine, the team was trained with the new protocol, with the participation of eighty-nine practitioners, among nurses and nursing technicians. At the same time, the hospital was asked to purchase the new solution, with the pharmacological team defining the dispensation and storage. The dentistry team was responsible for monitoring the whole process, from the protocol revision to its implementation and final adjustments.

The hospital caters to adult patients and has three ICCs, and a semi-intensive care center called Poli 10. Patients hospitalized in the latter wait for beds in the ICC.³² The three ICCs and the Poli 10 have 35 beds in total. All patients hospitalized in ICC and Poli 10 received the oral hygiene technique prescribed by the new protocol, beginning August 12, 2010.

The inclusion criterion for the study was to be hospitalized in one of the three ICCs or Poli 10, and patients admitted to the nurseries, maternity wards, and emergency rooms were excluded.

The study was approved by the Committee of Ethics in Research of the Federal University of Minas Gerais (UFMG) under report number 0471.0.203.000-11, according to resolution number 196, dated October 10, 1996, and authorized by the hospital. The study was carried out to assess the insertion of Resident Dentists, under whose guidance the medical and nursing teams implemented a new protocol for oral hygiene with chlorhexidine in the ICC and Poli 10, beginning May 2010.

The study had two phases: first, secondary data collected by the hospital's CCIH (2008, 2009, 2010) was assessed. We then analyzed how the ICC health practitioners, such as doctors, nurses, physical therapists, and nursing technicians, as well as members of adjacent disciplines – such as speech therapy, pharmacy, nutrition, occupational therapy, and psychology – perceived the implementation of the new protocol.

After signing a free informed consent form, these practitioners answered a questionnaire. The data collected was analyzed and presented by rate of occurrence.

RESULTS

Between January 2008 and October 2011, 3,984 patients were hospitalized in the ICC for less than one day. Out of these, 1,360 (34%) evolved with 1,795 nosocomial infections, with an average of approximately one new infection per day, in one out of three patients.³⁴

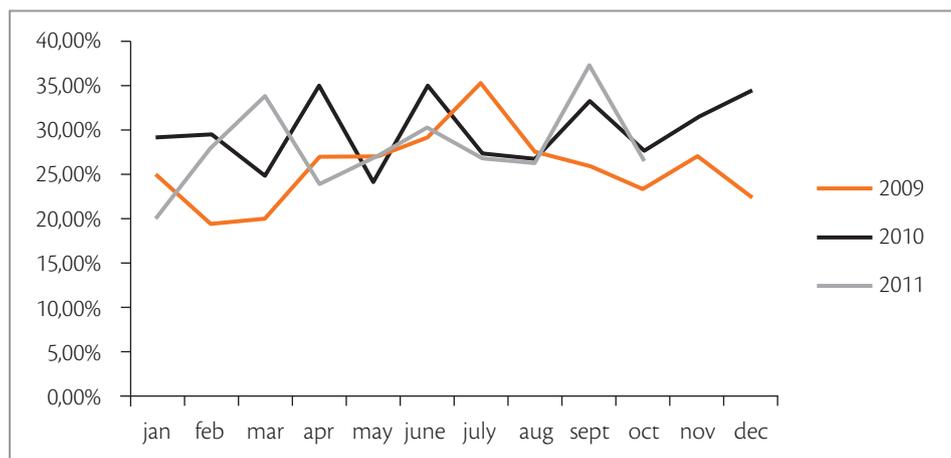
The hospital has a variable mortality rate, probably because of the high complexity and severity of the patients admitted. All patients are assessed using APACHE II, whose index evaluates the severity of ICC patients, based on clinical-laboratorial variables, age, and chronic disease in the first 24 hours, transforming data into probability of death.³⁵ In 2010, the mean

APACHE II score was 28 points, and in 2011, 27 points, a mean mortality rate of 55%. Picture 1 shows the variation of the mortality rate.

Treatment outcome can influence the length of hospital stay, especially in the case of patient death. As the mortality rate oscillates, this rate also changes, as seen in Picture 2.

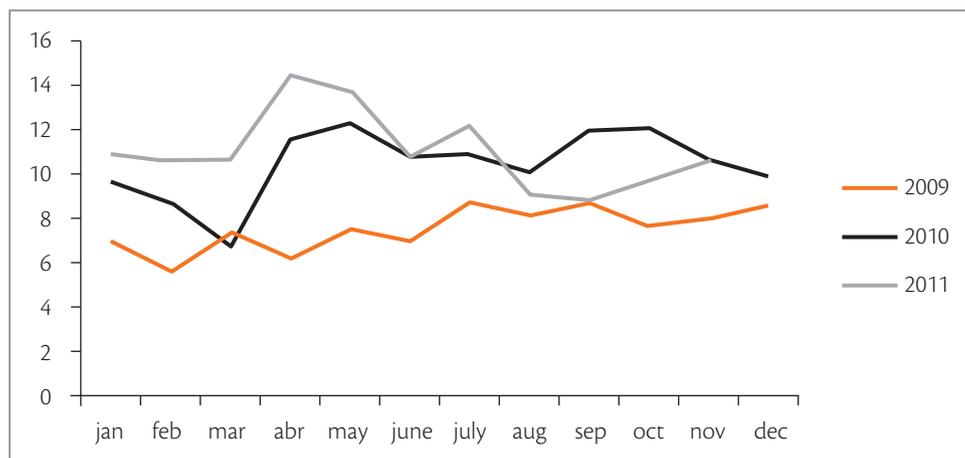
Table 1 shows the main infections developed by patients from 2008 to 2011 (Jan-Oct), and pneumonia is the leading cause of infection in the ICC in 2008, 2009, and 2010. Since it is a severe infection with high risk of morbimortality and high hospital costs, new measures of interventions were needed to correct this trend.

In the past 3 years, hospitalized patients had a 35% risk of evolving with a nosocomial infection after ICC admission. The main measure adopted by the hospital was implementing the VAP prevention bundle, led by the Institute for Healthcare Improvement (IHI),²⁷ in order to enhance healthcare assistance.



Picture 1 - ICC mortality rate.

Source: CCIH – Hospital Risoleta Tolentino Neves, 2011.



Picture 2 - ICC permanence rate.

Source: CCIH – Hospital Risoleta Tolentino Neves, 2011.

Table 1 - Main infections diagnosed at the ICC: 2008-2011 (Jan/Oct)

Year	1st	2nd	3rd	4th
2008	Pneumonia	Cardiovascular system infection	Lower airways respiratory infection (except pneumonia)	Urinary tract infection
2009	Pneumonia	Lower airways respiratory infection (except pneumonia)	Cardiovascular system infection	Urinary tract infection
2010	Pneumonia	Lower airways respiratory infection (except pneumonia)	Bloodstream infection	Cardiovascular system infection
2011	Bloodstream infection	Pneumonia	Lower airways respiratory infection (except pneumonia)	Urinary tract infection

Source: CCIH – Hospital Risoleta Tolentino Neves, 2011.

The medical and nursing teams implemented the VAP prevention bundle in May 2010, soon after the introduction of the dentistry team to the ICC. During this process, the dentistry team adjusted the oral hygiene protocol and trained the nursing team (including nurses and technicians) as to its use. The new protocol was implemented in August 2010, as part of the bundle, and contributed for decreasing VAP rates. This decrease in pneumonia rates had a direct impact in the infections diagnosed at the ICC. In 2011, bloodstream infections became the leading infection in the ICC (Table 1).

On August 12, the oral hygiene protocol was implemented as part of the bundle, and resulted in further significant re-

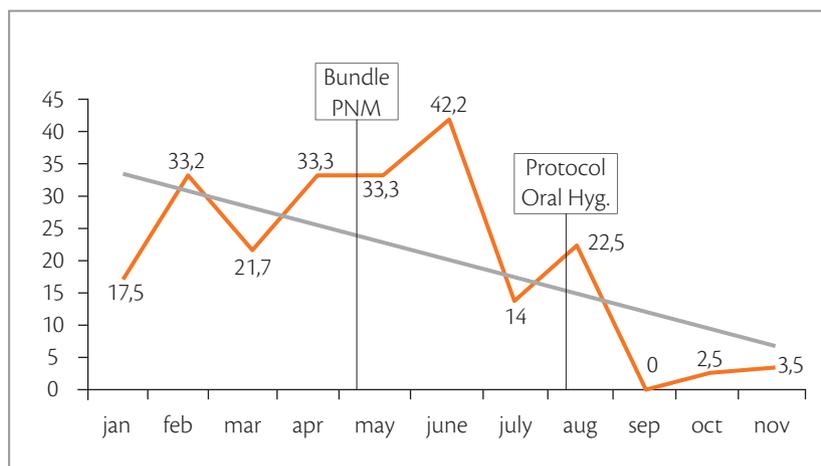
ductions in pneumonia rates (Picture 3). The reduction ranged from 33.3% to 3.5% from the time the bundle was implemented until the oral hygiene protocol was incorporated into it. The effectiveness of the measures implemented was only possible by integrating the entire healthcare team.

Evidence of the decrease in the pneumonia rates in the last year of the study up to now is shown on Picture 4, representing the density of pneumonia rate.

Fifty-six practitioners filled out the questionnaire assessing the introduction of the dentistry team in the ICC in 2010, after signing the free consent form, as follows: 3% medicine, 23% nursing, 7% physiotherapy, 2% nutrition, 2% psychology, 4% pharmacy, 7% speech therapy, 9% occupational therapy, and 43% nursing technicians.

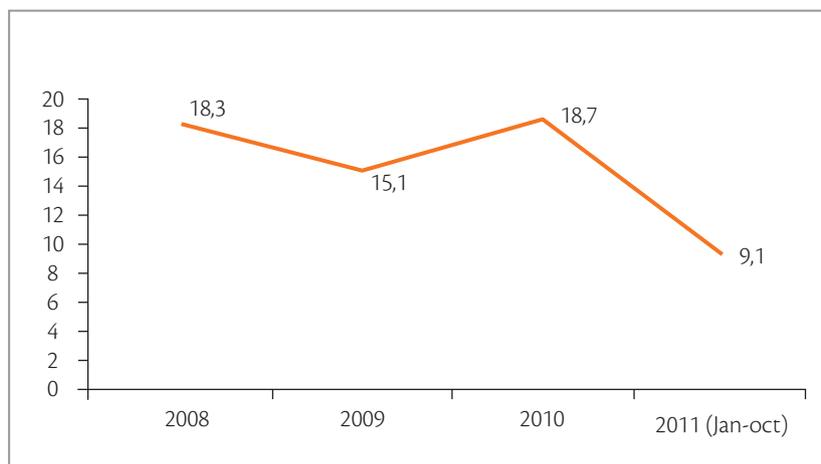
Regarding the practitioners' knowledge of the nosocomial infection rate, 82% answered that they knew, 9% did not know, and 9% could not answer. As to the rate of VAP, only 59% knew, 30% did not know, and 11% could not answer; 52% reported that the rates improved, 14% worsened, and 34% could not say.

Interviewees were asked about reasons leading to an improvement in pneumonia rates, and most did not know (29%). Twenty-seven percent mentioned that the team training could have contributed to better rates, followed by oral hygiene (11%), use of personal protective equipment (PPE) and hand-washing (6%), aspiration (5%), elevation of the head end of the bed, oral diet, and CCIH vigilance, each with 2%. Out of the 14% of interviewees who reported worse pneumonia rates, the reasons were: the team's lack of knowledge (11%), problems related to aspiration (5%) due to the greater patient severity and longer times under MV; use of antimicrobials (3%); and 2% mentioned lack of assistance from physiotherapy.



Picture 3 - Pneumonia infection rates in the ICC, from January to November 2010.

Source: CCIH – Hospital Risoleta Tolentino Neves, 2011.



Picture 4 - Density of pneumonia rate in the ICC (2008-2011): global analysis, including cases not associated to invasive procedures.
 Source: CCIH – Hospital Risoleta Tolentino Neves, 2011.

Regarding the impact of the dentistry team, 62% acknowledged its contribution to better pneumonia rates, 27% could not say, and 9% answered that it did not contribute, and 2% did not answer. All of the interviewees (100%), however, saw the dentists' actions in preventing and treating oral pathologies in the ICC patient and their insertion in the multidisciplinary assistance as favorable.

DISCUSSION

The mouth should be seen by all healthcare practitioners as part of the body, not to be ignored in the care of hospitalized patients, and to be tended for as all other parts. The oral micro-environment and colonization by pathogenic microorganisms are extremely relevant in the physiopathology of pneumonias, mainly with low levels of consciousness. This condition favors microaspiration of secretions from the oropharynx, which can reach up to 70%.¹² Moreover, deficient oral hygiene is a risk factor for developing pneumonias. Several authors report that an effective program of oral hygiene distinctly contributes in reducing pneumonia rates.^{3-10,33,36}

The pneumonia prevention bundle is a group of measures based on evidence that are able, jointly, to act in all patients under MV and significantly reduce pneumonia rates.²⁷ In the present study there was an association between the implementation of an oral hygiene protocol and the pneumonia prevention bundle at different times and a decrease in VAP indices. Thus, we sustain that the protocol should be incorporated in the bundle as a preventive and effective measure. For that to happen, hospitals have to assimilate the dental surgeon in their healthcare team, for he or she can recognize the inherent oral pathologies and is able to assess, diagnose, treat, and prevent complications. The Brazilian Health Surveillance Agency Anvisa recommends, based on strong evidence, oral

hygiene with chlorhexidine as one of the specific measures in preventing pneumonia.³⁷

Introducing dentistry in this new scenario is already a reality in some hospitals, even if in sectors other than ICCs, such as in maxillofacial surgery, the treatment of patients with special needs, and oncology. By broadening the dentist's range in preventing VAP, the dental surgeon has a new field to explore and in which to develop highly complex new skills.

In the questionnaire, when asked about reasons for improved pneumonia rates, 11% mentioned oral hygiene, and 62% mentioned the contribution of the dentists in implementing the oral hygiene protocol. This can be attributed to a memory bias, since the questionnaire was applied approximately a year after the dentistry team was introduced, and as well as by the flux of practitioners that left or began working at the service during that period.

When assessing the introduction of the dentistry team, all healthcare practitioners recognize the need for a dentist in the multidisciplinary team, in order to complement the integral health assistance of patients.

CONCLUSION

In this study, the implementation of a new oral hygiene protocol incorporated to the measures prescribed by a VAP prevention bundle had a marked and direct impact in reducing MVRP.

Incorporating a dental surgeon in the multidisciplinary team in ICCs is, therefore, a sound strategy for preventing infections and complementing integral health assistance. For this end, further studies are still needed, with longer follow-up periods, so that the dental surgeon's action in the ICC can be optimized, and to make sure the protocols can be developed so as to remain effective and up-to-date.

REFERENCES

- Morais TMN, Silva A, Knobel E, Avi ALRO, Lia RCC. Pacientes em unidades de terapia intensiva: atuação conjunta dos médicos e dos cirurgiões-dentistas. In: Serrano JR CV, Oliveira MCM, Lotufo RFM, Moraes RGB, Morais TMN, coordenadores. *Cardiologia e odontologia: uma visão integrada*. São Paulo: Livraria Santos; 2007. cap.15, p.249-70.
- Beraldo CC, Andrade D. Higiene bucal com clorexidina na prevenção de pneumonia associada à ventilação mecânica. *J Bras Pneumol*. 2008; 34(9):707-14.
- Chlebicki MP, Safdar N. Topical chlorhexidine for prevention of ventilator-associated pneumonia: a meta-analysis. *Crit Care Med*. 2007; 35(2):595-602.
- Muscerere J, Dodek P, Keenan S, Fowler R, Cook D, Heyland D, et al. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: prevention. *J Crit Care*. 2008; 23: 126-37.
- Chan EY, Ruest A, Meade MO, Cook DJ. Oral decontamination for prevention of pneumonia in mechanically ventilated adults: systematic review and meta-analysis. *Br Med J*. 2007; 334(7599):889.
- Ruffell A, Adamcova L. Ventilator-associated pneumonia: prevention is better than cure. *Nurs Crit Care*. 2008 Jan-Feb;13(1):44-53.
- Tantipong H, Chantana M, Jaiyindee S, Thamlikitkul V. Randomized Controlled Trial and Meta-analysis of Oral Decontamination With 2% Chlorhexidine Solution for the Prevention of Ventilator-Associated Pneumonia. *Infect Control Hosp Epidemiol*. 2008; 29:131-6.
- Garcia R, Jendresky L, Colbert L. Reduction of Microbial Colonization in the Oropharynx and Dental Plaque Reduces Ventilator-Associated Pneumonia. APIC Conference, Jun 2004.
- Panchabhai TS, Dangavach NS, Krishnan A, Kothari VM, Karnad DR. Oropharyngeal cleansing with 0.2% Chlorhexidine for prevention of Nosocomial pneumonia in critically ill Patients. *Chest*. 2009; 135:1150-6.
- Munro CL, Grap MJ, Jones DJ, Mcclish DK, Sesser CN. Chlorhexidine, Toothbrushing, and Preventing Ventilator-Associated Pneumonia in Critically Ill Adults. *Am J Crit Care*. 2009;18: 428-37.
- Fernandes AT, Zamorano PO, Torezan Filho MA. Pneumonia hospitalar. In: Fernandes AT, Fernandes MOV, Ribeiro Filho N. *Infecção hospitalar e suas interfaces na área de saúde*. São Paulo: Atheneu; 2000. cap.21, p.516-54.
- Amaral SM, Cortês AQ, Pires FR. Pneumonia nosocomial: importância do microambiente oral. *J Bras Pneumol*. 2009; 35(11):1116-24.
- Pereira CA, Carvalho CRR, Silva JLP, Dalcolmo MMP, Messeder OHC. Consenso Brasileiro de Pneumonias em Indivíduos Adultos Imunocompetentes. *J Pneumol*. 2001; 27: 22-41.
- CDC. The National Healthcare Safety Network (NHSN) Manual. Healthcare personnel safety component protocol, 2009. [Citado em 2011 set 10]. Disponível em: http://www.cdc.gov/nhsn/PDFs/HSPmanual/HPS_Manual.pdf.
- Pinheiro PG, Salani R, Aguiar ASW, Pereira SL. Perfil periodontal de indivíduos adultos traqueostomizados com pneumonia nosocomial. *Rev Periodont*. 2007;17(3):67-72.
- Oliveira LCBS, Carneiro PPM, Fisher RG, Tinoco EMB. A presença de patógenos respiratórios no biofilme bucal de pacientes com pneumonia nosocomial. *Rev Bras Ter Intens*. 2007; 19(4): 428-43.
- Pace MA, Watanabe E, Facetto MP, Andrade D. *Staphylococcus spp.* na saliva de pacientes com intubação orotraqueal. *Rev Panam Infectol*. 2008;10(2):8-12.
- Morais TMN, Silva A, Avi ALRO, Souza PHR, Knobel E, Camargos LFA. A importância da atuação odontológica em pacientes internados em unidade de terapia intensiva. *Rev Bras Ter Intens*. 2006;18(4):412-7.
- Bergmans DC, Bonten MJ, Gaillard CA, Paling JC, Geest SVD, Tiel FHV et al. Prevention of ventilator-associated pneumonia by oral decontamination: a prospective, randomized, double-blind, placebo-controlled study. *Am J Respir Crit Care Med*. 2001; 164(3):382-8.
- Santos PSS, Mello WR, Wakim RCS, Paschoal MAG. Uso de solução bucal com sistema enzimático em pacientes totalmente dependentes de cuidados em unidade de terapia intensiva. *Rev Bras Ter Intens*. 2008; 20(2):154-9.
- Araújo RJG, Oliveira LCG de, Hanna LMO, Correa AM, Carvalho LHV, Álvares NCF. Análise de percepções e ações de cuidados bucais realizados por equipes de enfermagem em unidades de tratamento intensivo. *Rev Bras Ter Intens*. 2009; 21(1):38-44.
- Reche NSG. Controle da placa dental em deficientes mentais com o uso da clorexidina. 2005. 72 p. Dissertação (Mestrado em Clínica Odontológica). Marília-SP: Universidade de Marília; 2005.
- Zanatta FB, Rösing CK. Clorexidina: mecanismo de ação e evidências atuais de sua eficácia no contexto do biofilme supragengival. *Scientific-A* 2007; 1(2):35-43.
- Tortora GJ, Funke BR, Case CL. Controle do crescimento microbiano. In: Tortora GJ, Funke BR, Case CL. *Microbiologia*. 6ª ed. Porto Alegre: Artmed; 2000. p.181-206.
- Gebran MP, Gebert APO. Controle químico e mecânico de placa bacteriana. *Tuiuti: ciência e cultura*, Curitiba 2002; (26):45-58.
- Fávero MLD, Pontarolo R, Sato MEO, Andrezza IF, Machado A. Desenvolvimento de dentífrico como veículo para o uso de digluconato de clorexidina no controle químico da placa bacteriana, 2004 [dissertação]. Programa de pós- graduação em ciências farmacêuticas – Universidade Federal do Paraná, Curitiba, 2004.
- 5 Million Lives Campaign. Getting Started Kit: Prevent Ventilator Associated Pneumonia. Cambridge MA: Institute for Healthcare Improvement; 2008. [Citado em: 10 ago. 2011]. Disponível em: www.ihl.org.
- Munro CL, Grap MJ. Oral health and care in the intensive care unit: state of the science. *Am J Crit Care*. 2004; 13(1):25-33.
- Grap MJ, Munro CL, Ashtiani B, Bryant S. Oral care interventions in critical care: frequency and documentation. *Am J Crit Care*. 2003; 12(2):113-8.
- Koeman M, Ven AJAMVD, Hak E, Joore HCA, Kaasjager K, Smet AGA et al. Oral decontamination with chlorhexidine reduces the incidence of ventilator-associated pneumonia. *Am J Respir Crit Care Med* 2006;173(12):1348-55.
- Agência Nacional de Vigilância Sanitária. Resolução-RDC nº 7, de 24 de fevereiro de 2010. [Citado em 2011 set 12]. Disponível em: URL: <http://www.amib.org.br/pdf/RDC-07-2010.pdf>.
- Hospital Risoleta Tolentino Neves. Histórico. 2011. [Citado em 2011 jun 10]. Disponível em: http://www.hrtn.fundep.ufmg.br/index.php?option=com_content&task=blogsection&id=6&Itemid=86.
- Souza AF, Neves ALC, Benevenuto MEAC, Costa PM. Uso da clorexidina 0,12% na higiene oral de pacientes em unidade de terapia intensiva. 2009. 88f. Monografia (Graduação em Enfermagem) – Belo Horizonte, Faculdade de Enfermagem, Universidade José do Rosário Vellano; 2009.
- Hospital Risoleta Tolentino Neves. Serviço de Controle de Infecções Hospitalares: Risco de Infecção associada à assistência e taxas de letalidade no Centro de Tratamento Intensivo: Jan de 2008 a out de 2011. Belo Horizonte nov 2011.
- Moreno R. The customization of APACHE II for patients receiving orthotopic liver transplants. *Critical Care*. 2002, 6:188-189.
- Ames NJ, Sulima P, Yates JM, McCullagh L, Gollins SL, Soeken K, Wallen GR. Effects of Systematic Oral Care in Critically Ill Patients: A Multicenter study. *AJCC*. 2011; 20(5):
- Agência Nacional de Vigilância Sanitária. Infecções do trato respiratório orientações para prevenção de infecções relacionadas à assistência à saúde. Brasília: Anvisa; 2009.