Adherence to the Bundle for Prevention of Pneumonia Associated with Mechanical Ventilation

Adesão ao Bundle de Prevenção da Pneumonia Associada à Ventilação Mecânica
Adhesión al Paquete de Prevención de Neumonía Asociada a Ventilación Mecánica

RESUMO

Objetivo: verificar a adesão do Bundle de prevenção da Pneumonia Associada à Ventilação Mecânica em um centro de terapia intensiva de um Hospital Público Universitário. **Método:** estudo observacional, descritivo, prospectivo, com abordagem quantitativa. A população alvo foram pacientes adultos em ventilação mecânica por um período superior a 48 horas. Os dados foram coletados por dois meses pela aplicação do *checklist* para verificação dos cuidados do *bundle*. **Resultados:** Foram realizadas 58 observações acerca da conformidade dos cuidados do *bundle*, quanto a higiene oral (79,25%), elevação da cabeceira (43,10%), pressão do *cuff* (49,12%), sujidade no circuito ventilatório (46,55%), circuito livre de condensação (84,48%) e sistema fechado de aspiração (100%). **Conclusão:** Não ocorreu adesão total das medidas recomendadas do *bundle*, visto que os cuidados devem ser realizados de forma associada para a obtenção da prevenção da Pneumonia Associada à Ventilação Mecânica.

DESCRITORES: Pneumonia; Pneumonia associada à ventilação mecânica; Unidades de terapia intensiva; Cuidados de enfermagem.

ABSTRACT

Objective: To verify adherence to the bundle for the prevention of Ventilator-Associated Pneumonia in an intensive care unit of a Public University Hospital. **Method:** Observational, descriptive, prospective study with a quantitative approach. The target population was adult patients on mechanical ventilation for a period longer than 48 hours. Data were collected over two months through the application of a checklist to verify bundle care. **Results:** A total of 58 observations were made regarding compliance with bundle care: oral hygiene (79.25%), head-of-bed elevation (43.10%), cuff pressure (49.12%), dirtiness in the ventilatory circuit (46.55%), condensation-free circuit (84.48%), and closed suction system (100%). **Conclusion:** Full adherence to the recommended bundle measures did not occur, as care must be performed in an associated manner to achieve the prevention of Ventilator-Associated Pneumonia.

DESCRIPTORS: Pneumonia; Ventilator-associated pneumonia; Intensive care units; Nursing care.

RESUMEN

Objetivo: Verificar la adhesión al bundle de prevención de la Neumonía Asociada a la Ventilación Mecánica en una unidad de cuidados intensivos de un Hospital Público Universitario. **Método:** Estudio observacional, descriptivo, prospectivo, con enfoque cuantitativo. La población objetivo fueron pacientes adultos en ventilación mecánica por un período superior a 48 horas. Los datos fueron recolectados durante dos meses mediante la aplicación de una lista de verificación para comprobar los cuidados del bundle. **Resultados:** Se realizaron 58 observaciones sobre la conformidad de los cuidados del bundle: higiene oral (79,25%), elevación de la cabecera (43,10%), presión del cuff (49,12%), suciedad en el circuito ventilatorio (46,55%), circuito libre de condensación (84,48%) y sistema cerrado de aspiración (100%). **Conclusión:** No hubo adhesión total a las medidas recomendadas del bundle, ya que los cuidados deben realizarse de forma asociada para lograr la prevención de la Neumonía Asociada a la Ventilación Mecánica.

DESCRIPTORES: Neumonía; Neumonía asociada a la ventilación mecánica; Unidades de cuidados intensivos; Cuidados de enfermería.

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INTRODUCTION

In the hospital environment, specifically in the intensive care unit (ICU), tools for the diagnosis and treatment of critically ill patients have been developed and refined. Patients with a high level of complexity are admitted to the ICU and undergo various invasive procedures[1].

In this sense, healthcare-associated infections (HAIs) are very common in hospital units, among which pneumonia, caused by infiltration into the lung parenchyma, stands out[2].

Nosocomial pneumonia is still recognized as one of the leading causes of hospital admission in Brazil and has a high mortality rate. During 2019, 162,005 deaths from respiratory diseases were recorded, with 83,080 deaths from pneumonia in the Unified Health System (SUS).[3-4]

Intensive care units are recognized as centers for the care of critically ill patients, mostly intubated and connected to mechanical ventilation (MV), which, despite being a necessary mechanism for sustaining life, can trigger numerous complications, including ventilator-associated pneumonia (VAP). Recognized by the Brazilian Health Regulatory Agency (ANVISA) as pneumonia confirmed between 48 and 72 hours after orotracheal intubation and the start of mechanical ventilation, its diagnosis is confirmed through clinical, radiological, and laboratory criteria[5].

Some conditions influence the onset and progression of the disease, such as the level of sedation, coma, gastrointestinal reflux, aspiration of substances from the oropharyngeal region, the use of a nasogastric tube, inadequate hand hygiene, and length of hospital stay. In addition, the patient's clinical condition, such as malnutrition, aging, and comorbidities, are identified as elements that can increase the risk of VAP[5-6].

Care bundles are recognized as a set of practical procedures based on the best evidence and, when performed together, improve outcomes. The VAP bundle includes multiple care measures with different levels of evidence: performing hand hygiene; minimizing sedation; raising the head of the bed to 30–45°; predicting and anticipating ventilator weaning; performing early tracheostomy (when indicated); providing ongoing and continuing education to the team; and changing the ventilator circuit only if it is visibly dirty or defective[7-8].

In this sense, the research question was defined as follows: What care measures related to the Ventilator-Associated Pneumonia Bundle are being adhered to in mechanically ventilated patients?

The objective of the study is to verify adherence to the Ventilator-Associated Pneumonia Prevention Bundle in the care of mechanically ventilated patients in an ICU.

METHODS

This study presents a quantitative, observational, descriptive methodological approach, as it does not involve interventions, but rather the observation of events. In addition, it is classified as prospective, since it begins in the present and follows the patient for a certain period [9-10].

The study was conducted between February and April 2024 in a 10-bed clinical ICU at a public university teaching hospital located in the state of Rio de Janeiro.

The target population of the study consisted of adult patients, aged 18 years or older, on mechanical ventilation, admitted to the general clinical ICU. All patients using ventilatory prostheses (orotracheal tube or tracheostomy cannula) were included. The exclusion criteria were patients using ventilatory prostheses for less than 48 hours, since MVAP is proven between 48 and 72 hours after orotracheal intubation and the start of mechanical ventilation[5].

The sample was defined for convenience and consisted of 10 adult patients. Fifty-eight observations were made during this period using the checklist as a data collection tool.

Data collection was performed using the structured observation technique, and a checklist adapted in Google Forms® , in accordance with ANVISAwas created as a data collection tool5 (2017), Rodrigues, Sampaio, Gondim, Lisboa, Beltrão, Pinto8 (2022) and the Standard Operating Procedure (SOP) for the Prevention of VAPM at the unit, implemented at the institution since 2020 and still in force today.

The Free and Informed Consent Form (FICF) was signed in advance by the responsible family member. Sociodemographic and clinical data were collected directly from the patient's medical record, available in the 'SOUL MV Hospitalar'® . In addition, the form was in formatsystem-checklist, with options of "Not performed" and "Performed" for the care that could be verified: Perform oral hygiene with 0.12% chlorhexidine gluconate; Maintain elevated decubitus (30-45°); orogastric or nasogastric intubation; Control the pressure of the endotracheal tube cuff (20-30 cm/H20); Keep the ventilation circuit free of dirt; Keep the ventilator circuit free of water and condensation and the closed suction system. Data collection was performed only during the daytime and once a day.

The collection instrument was used at each collection opportunity, individually, for each patient meeting the inclusion criteria, allowing for more than one collection from each participant.

The data previously stored in Google Forms® were exported to Microsoft Excel® spreadsheets, version 2016, and then to Stata/IC® 16.0 software. Sociodemographic and clinical variables were analyzed by calculating crude frequencies and percentages for categorical variables and measures of position and dispersion for quantitative variables.

The project was approved under substantiated opinion No. 6,624,579.

RESULTS

Ten patients participated in the study, equally divided between females and males, with a predominance of the 51-70 age group.

Among the comorbidities presented by the patients, diabetes was predominant (20.6%), followed by hypertension (16.7%),

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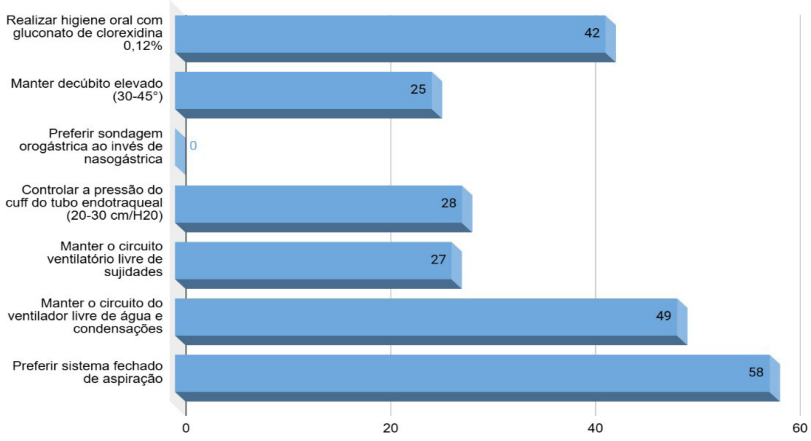
obesity (7.8%), and non-Hodgkin's lymphoma (7.8%). The reason for the participants' admission to the ICU was respiratory failure (f=5) and septic shock (f=3).

Regarding the length of stay in the ICU, the average time was 17.6 days (SD = ±10.52), with a minimum of 4 days and a maximum of 34 days. The average intubation time was 12.7 days (SD = ±5.59), with a minimum of 4 days.

Fifty-eight observations were made regarding compliance with VAPM Bundle care, as shown in the table and graph below.

Graph 1 - Distribution of care provided in relation to the mechanical ventilation-associated pneumonia bundle



Source: The authors, 2024.

In this sense, the care "Prefer closed suction system" and "prefer orogastric or nasogastric tube" were found in all observations. It was evident that in 33 observations (56.90%) the care "Maintain elevated decubitus (30-45°)" was not performed, as well as in 53.45% of the observations that portray the non-performance of the care "Keep the ventilatory circuit free of dirt" (f=31).

Regarding the care "Keep the ventilator circuit free of water and condensation," it was identified that 84.48% of the care was performed (f=49) and 79.25% of "Perform oral hygiene with 0.12% chlorhexidine gluconate" was performed (f=42).

Table 1 - Implementation of care related to the mechanical ventilation-associated pneumonia bundle

Care	Performed f (%)	Not performed f (%)
1. Perform oral hygiene with 0.12% chlorhexidine gluconate	42 (79,25)	11 (20,75)
2. Maintain elevated decubitus (30-45°)	25 (43,10)	33 (56,90)
3. Control the pressure of the endotracheal tube cuff (20-30 cm/H20)	28 (49,12)	29 (50,88)
4. Keep the ventilation circuit free of debris	27 (46,55)	31 (53,45)
5. Keep the ventilator circuit free of water and condensation	49 (84,48)	9 (15,52)
6. Prefer a closed suction system	58 (100)	0

Note: Nurses are not allowed to control the pressure of the endotracheal tube cuff in this sector of the institution.
Source: The authors, 2024.

Compliance with three care items was verified in 29.31% of cases, followed by compliance with four and five care items in 27.59% of cases. Compliance with two and six care items was less frequent, found in 8.62% and 6.90% of cases, respectively. Only 8.6% of observations showed that no care items were complied with.

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Table 2 - Characterization of the number of care measures performed in relation to the mechanical ventilation-associated pneumonia bundle

Number of care items performed	N	%
Two measures	5	8,62
Three precautions	17	29,31
Four precautions	16	27,59
Five precautions	16	27,59
Six precautions	4	6,90

Source: The authors, 2024.

DISCUSSION

The predominant age group in the ICU is over 60 years old, which is consistent with the age group found in the survey, between 51 and 60 years old (f=3) and 61-70 years old (f=3), being a predominantly elderly population[11-12].

Among the most commonly observed comorbidities in ICUs are diabetes (20.6%) and hypertension (16.7%), which are the most frequent conditions in the literature, considered risk factors for other diseases and contributing to increased mortality.

It is worth noting that the main reasons for hospitalization described in patients admitted to the ICU are related to cardiovascular diseases, respiratory diseases, and sepsis, which also resembles, in part, the results obtained in the research, mainly respiratory failure and septic shock[12-13-14].

Regarding length of stay, the study found that 50% of participants had an average length of stay of 10 days and 66% of participants were intubated and mechanically ventilated. The length of stay found differed from the literature, which indicated that the length of stay of patients in the ICU was 11.2 days. The mortality rate in the present study was 50% (f=5) among 10 participants observed, which corresponds to the study by the author mentioned, which obtained a mortality rate of 54%[11].

This data demonstrates a major challenge for the nursing team, since one of the main complications of ventilated patients is VAP, knowing that it increases the mortality rate, especially late-onset VAP compared to early-onset VAP.[15]

Oral hygiene with 0.12% chlorhexidine gluconate was performed in 79.25% of the 53 checks of this care. Mechanically ventilated patients are prone to biofilm accumulation caused by the presence of the intubation device, which interferes with the cough reflex and reduces salivary production. Thus, oral hygiene is imperative in the care of ventilated patients[16].

In 2010, the Institute for Healthcare Improvement (IHI) implemented the use of chlorhexidine as part of oral hygiene care for mechanically ventilated patients.17 ANVISA (2017)[5] uses the 2014 guidelines of the Society of Healthcare Epidemiology of America (SHEA), which recommend oral hygiene with 0.12% chlorhexidine.

Recently, in 2022, SHEA discussed the use of chlorhexidine as a moderate-strength evidence-based care measure, i.e., no longer recommended as the gold standard for daily care, since no strong evidence was found to support oral hygiene with 0.12% chlorhexidine[7].

In the sample studied, oral hygiene was not performed in 20.75% of the 53 opportunities observed for this care. This result leads to reflection on the application of care packages, since bundles are recognized as a set of practical behaviors based on the best evidence, which when performed together improve results.(18)Thus, the absence of one of the care measures contributes to the failure of VAP prevention.

Despite the scientific duality that exists in a theoretical scenario of progression toward the disuse of chlorhexidine, it is essential to understand the importance of its use, such as in the prevention of biofilm formation.

In the 58 observations, the care measure "Maintain elevated decubitus (30-45°)" was not performed in 56.9% of cases, which coincides with a study that also mentions low adherence to this practice, justified by the need for frequent decubitus changes and various procedures performed throughout the day, which makes it difficult to keep the head elevated.19

Although it is an easy and low-cost practice to implement, the result of non-compliance observed in this study may contribute to the reflection of the professionals present on the results found and also motivate and involve them in a proposal for the collective construction of a practice that reduces risks and improves results.

Regarding mechanical ventilation care in this scenario, responsibilities related to orotracheal tube (OTT) care include controlling cuff pressure, which is set at 20 to 30 cmH2O. In the case of cuff hyperinflation, i.e., pressures above 30 cmH2O, damage to the trachea is likely to occur, such as mucosal ischemia, cartilage injury,

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stenosis, and tracheoesophageal fistula. It is worth mentioning that one of the duties of nursing is the fixation and evaluation of the TOT.(20)

Different studies address the importance of implementing protocols for MVAP, and different values are found in the literature regarding the established standard for cuff pressure, ranging from 25 to 34 cmH2O, 20 to 30 cmH2O, and 25 to 35 cmH2O[21-22].

Among the 57 observations made to visualize cuff pressure (20-30 cmH2O), it was possible to identify 29 non-conformities (50.88%), as well as in the literature, studies mention a significant non-conformity of care represented in the verification during the three collection periods: morning, afternoon, and evening[23].

Still in relation to mechanical ventilation, the care items "Keep the ventilation circuit free of dirt" and "Keep the ventilator circuit free of water and condensation" stand out. These care items were performed in 46.55% and 84.48% of the 58 observations, respectively.

In a study prior to the educational intervention, the care of checking for the absence of liquids in the trachea circuit and humidifier filter had an adherence rate of 55.6%, while after the educational activity, it was 72.8%. These results demonstrate once again that staff training and involvement is imperative for improving expected outcomes[19].

It is worth mentioning that it is a high-level evidence recommendation that ventilator circuits be replaced if they are visibly dirty or malfunctioning.

As for "Prefer closed suction system," it is known that suction should be performed on mechanically ventilated patients as a practice to improve ventilation and can be performed in an open or closed system, with no substantial difference between the two modalities in the incidence of VAP.5

The closed suction system has moderate evidence, but its practice is not discouraged despite not having a direct impact on the occurrence of VAP.[7]

However, the closed suction system reaches secretions in the lower respiratory tract, reducing the risk of contamination by contact and aerosols, and is associated with a decrease in the duration of hypoxia due to the absence of the need to disconnect the system. Nevertheless, the tube and circuit must be kept clean and changed every 72 hours or if damaged[5-24].

The adoption of an aseptic technique based on the best scientific evidence reduces the risk of colonization by undesirable microorganisms in the lower airways, thus preventing VAP.

There are other precautions mentioned that were not addressed in the data collection, as more specific collections would be necessary to observe their implementation. The most frequently mentioned in studies are: hand hygiene; minimizing daily sedation; locating the enteral tube in the gastric or post-pyloric position; and continuing education of the team[24-7].

Thefollowing are also cited as essential practices: avoiding intubation and preventing reintubation; maintaining and improving physical conditioning; providing early enteral versus parenteral nutrition[7].

CONCLUSION

This study verified adherence to the VAP prevention bundle in the care of mechanically ventilated patients in an ICU of a public university hospital. It was concluded that there was no full adherence to the measures observed and recommended in the VAP prevention bundle. Therefore, the VAP bundle is a resource that can be implemented within healthcare facilities; however, its practice must be encouraged and monitored in its daily execution, aiming for higher adherence rates.

It is possible to identify a low adherence rate in some care measures, which undermines the purpose of the bundle's applicability, since care must be provided in an integrated manner to prevent VAP.

Finally, the study's findings clarify the need to implement continuing education and update the care package. Therefore, there is a need for intervention by nursing managers and continuing education services to improve adherence among the professionals involved, aiming to reduce avoidable errors and improve the quality of care provided to patients on ventilatory support with the best scientific evidence.

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References

1 Araújo ACS, Oliveira RP, Lima RN. Cuidados de enfermagem em dispositivos de procedimentos invasivos utilizados na unidade de terapia intensiva adulto. Rev. Bras. Interdiscip. Saúde. 2022 [cited 2023 out 12]; 4(2). Available from:https://revistateste2.rebis.com.br/index.php/revistarebis/article/view/251/198.

2 Agência nacional de vigilância sanitária. Programa nacional de prevenção e controle de infecções relacionadas à assistência à saúde (PNPCIRAS) 2021 a 2025. Brasília: ANVISA; 2021 [cited 2023 maio 20]. Available from: https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/publicacoes/pnpciras_2021_2025.pdf.

3 Departamento de Informática do Sistema Único de Saúde. Pneumonia: mortalidade. Brasília: Ministério da Saúde; 2019 [cited 2023 jun. 14]. Available from: http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sim/cnv/obt10uf.def.

4Nogueira FA, Oliveira SLS, Ferreira RAOF, Campos SBl. Fisiopatologia pneumônica: aspectos epidemiológicos, diagnóstico e tratamento. Revista RECIFAQUI. 2021[cited 2023 maio 20]; 3(11): 122-147. Available from: https://recifaqui.faqui.edu.br/index.php/recifaqui/article/view/113/104.

5 Agência nacional de vigilância sanitária. Medidas de Prevenção de Infecção Relacionada à Assistência à Saúde. Brasília: ANVISA; 2017 [cited 2023 jul. 20]. Available from: http://www.riocomsaude.rj.gov.br/Publico/MostrarArquivo.aspx?C=pCiWUy84%2BR0%3D.

6 Nóbrega LMB, Vasconcelos JMB, Morais JLP, Araújo CC, Neto JMR, Leite AC. Pneumonia associada à ventilação mecânica em pacientes graves de uma unidade de terapia intensiva, Enferm. Foco. 2021 [cited 2023 maio 20]; 12(4): 746-52. Available from: http://revista.cofen.gov.br/index.php/enfermagem/article/view/4525/1224&sa=D&source=docs&ust=1687484118420485&usg=AOvVaw1qZzWcv5e_j0E3RQxaGOGa.

7 Klompas M, Branson R, Cawcutt K, Crist M, Eichenwald EC, Greene LR, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals:2022 Update. Infect. Control Hosp. Epidemiol. 2022 [cited 2024 jun 3]; 43: 687-713. Available from:https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/strategies-to-prevent-ventilatorassociated-pneumonia-ventilatorassociated-events-and-nonventilator-hospitalacquired-pneumonia-in-acutecare-hospitals-2022-update/A2124BA9B088027AE30BE46C28887084.

8 Rodrigues AL, Sampaio RL, Gondim ES, Lisboa KWSC, Beltrão ICSL, Pinto SL. Ações de enfermagem na prevenção da pneumonia associada à ventilação mecânica: Uma revisão integrativa. Nursing (Edição Brasileira). 2022[cited 2023 out 13]; 25 (293):8748–8761. Available from: https://www.revistanursing.com.br/index.php/revistanursing/article/view/2793.

9 Fonseca JJS. Metodologia da pesquisa científica. Fortaleza: Universidade Estadual do Ceará, 2002 [cited 2023 maio 16], 127 p. Available from: http://www.ia.ufrrj.br/ppgea/conteudo/conteudo-2012-1/1SF/Sandra/apostilaMetodologia.pdf.

10 Hulley SB, Newman TB, Cummings SR. Anatomia e Fisiologia da Pesquisa Clínica. In: Hulley SB, Cummings SR, Browner WS, Grady DG, Newman TB. Delineando a Pesquisa Clínica: Uma abordagem epidemiológica. Porto Alegre: Artmed; 2008 [cited 2023 out 7]. p. 21-33.

11. Montini GR, Mestrinari CR, Rodrigues AMS, Contrin LM, Werneck AL,Beccaria LM. Adesão ao bundle para prevenção de pneumonia associada à ventilação mecânica em terapia intensiva. CuidArte Enferm, 2020 [cited 2024 abr. 28]; 14(2), p. 172-180. Available from: https://www.webfipa.net/facfipa/ner/sumarios/cuidarte/2020v2/p.172-180.pdf.

12. Pauletti M, Otaviano MLPO, Moraes AST, Schneider DS. Perfil epidemiológico dos pacientes internados em um Centro de Terapia Intensiva. Aletheia,2017 [cited 2024 jun. 3]; 50 (1-2). Available from: http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1413-03942017000100004.

13. Castro MLM, Almeida FAC, Amorim EH, Carvalho AILC, Costa CC, Cruz RAO. Perfil de pacientes de uma unidade de terapia intensiva de adultos de um município paraibano. Enferm. Actual Costa Rica 2021 [2024 maio 10]; (40) DOI: http://dx.doi.org/10.15517/revenf.v0i40.42910. Available from: http://www.scielo.sa.cr/scielo.php?script=sci_arttext&pid=S1409-45682021000100007&lng=en&nrm=iso.

14. Vieira MS. Perfil geográfico e clínico de pacientes admitidos na UTI através da Central de Regulação de Internações Hospitalares. Comun. ciênc. saúde, 2011 [cited 2024 maio 12]; 22(3), p. 201-210. Disponível em: https://bvsms.saude.gov.br/bvs/periodicos/revista_ESCS_v22_n3_a02_Perfil_geografico_clinico.pdf.

15 Valles J, Pobo A, García-Esquirol O, Mariscal D, Real J, Fernández R. Excess ICU mortality attributable to ventilador-associated pneumonia: The role of early vs late onset. Intensive Care Medicine, 2007 [cited 2024 jun 5]; 33, p.1363-1368. Available from: https://link.springer.com/article/10.1007/s00134-007-0721-0.

16 Filho ACG, Martinez GL, Salomão AB, Crepaldi MG, Junior LEA, Panza LHV, et al. Microbiological profile of biofilm in the orotracheal tube of extubated patients: Literature review. Research, Society and Development, 2021[cited 2024 jun. 5];10 (7). Available from: https://rsdjournal.org/index.php/rsd/article/view/14661.

17 Mastrogianni M, Katsoulas T, Galanis P, Korompeli A, Myrianthefs P. O impacto dos pacotes de cuidados na prevenção da pneumonia associada à ventilação mecânica (PAV) em UTI de adultos: uma revisão sistemática. Antibiotics, 2023 [2024 jun. 03]; 2 (12). Available from: https://www.mdpi.com/2079-6382/12/2/227.

18 Institute for healthcare improvement [internet]. What is a Bundle?. Massachusetts: IHI, 01 mar. 2012 [cited 2024 jun 3]. Available from: https://www.ihi.org/insights/what-is-a-bundle.

19 Sachetti A, Rech V, Dias AS, Fontana C,Barbosa GL, Schlichting D. Adesão às medidas de um bundle para prevenção de pneumonia associada à ventilação mecânica. Rev. Bras. Ter. Intensiva,2014 [cited 2024 maio 12];26, p. 355-359. Available from: https://www.scielo.br/j/rbti/a/Rnwp98NPNGR6DnxKRhqr64w/#.

20 Oliveira ACC, Fidelis RR. Atuação do enfermeiro na prevenção as complicações associadas a ventilação mecânica em unidade de terapia intensiva. Braz. J. Hea. Rev, Curitiba, 2021 [cited 2024 abr. 28]; 4 (5), p. 21625-21635. Avaible from: https://ojs.brazilianjournals.com.br/ojs/index.php/BJHR/article/view/37249/pdf.

21 Baeder FM, Andrade KS, Corazza PFL, Martini K, Albuquerque ACL, Silva DF, et al. Controle da pressão do cuff na prevenção de broncoaspiração e desenvolvimento de pneumonia associada à ventilação mecânica durante manipulação da cavidade oral: uma revisão integrativa. Research, Society and Development, 2022 [cited 2024 jun 3]; 11(12). Available from:https://rsdjournal.org/index.php/rsd/article/view/34926.

22 Silva RM, Santos BRF, Erdmann NAC, Henriques KGG, Albuquerque TG, Boução DMN, et al. Importance of Cuff pressure control: Knowledge of the nursing team - prevention of infection related to health care. Research, Society and Development, 2021 [cited 2024 jun. 5]; 10(9). Available from: https://rsdjournal.org/index.php/rsd/article/view/18297.

23 Fernandes MKF, Ottoni ALJ, Lara MO, Carvalho NKS, Rocha IA, Oliveira LR, et al. Impacto Da Adesão Ao Bundle Na Prevenção De Pneumonia Associada À Ventilação Mecanica. In: Silva, M.R. et al.. Assistência Integral À Saúde: Desafios E Vulnerabilidades Da Assistência. Editora Científica Digital, 2023 [cited 2024 jun 3], cap. 12, p.178-193. Available from:https://www.editoracientifica.com.br/books/chapter/230914389.

24Honorato LR, Braga ALS, Souza DF, Nassar PRB, Azevedo SL. A eficácia dos cuidados preventivos da enfermagem na Pneumonia associada à ventilação mecânica. Research, Society and Development, 2021 [cited 2024 abr 28]; 10 (7). Available from: https://rsdjournal.org/index.php/rsd/article/view/15935.

DOI: https://doi.org/10.36489/nursing.2025v29i326p11110-11121