

Prevention of ventilator-associated pneumonia in adult intensive care units

Prevención de la neumonía asociada al ventilador en unidades de cuidados intensivos para adultos

Prevenção da pneumonia associada à ventilação mecânica em unidade de terapia intensiva em adultos

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Abstract

The aim was to analyze the nursing team's approach to the potential for VAP, as described in the scientific literature. Using an integrative literature review methodology, 87 articles were analyzed, of which 21 were selected for the study. The research highlights that guidelines and protocols, when implemented correctly, can significantly reduce the incidence of VAP. Effective preventive measures include elevating the head of the bed, discontinuing daily sedation, rigorous oral hygiene, and checking endotracheal tube cuff pressure. Nursing team adherence to these practices is crucial to ensuring patient safety and the effectiveness of preventive measures. The research emphasizes the need for continuing education for healthcare professionals and suggests the creation of educational materials, such as iconographic materials, to reinforce these practices in daily ICU settings. Consistent implementation of these measures can significantly improve patient safety and reduce hospital costs.

Descriptors: Pneumonia; Nursing Intensive Care; Artificial Respiration; Mechanical Ventilation; Intensive Care.

Resumén

El objetivo fue analizar el enfoque del equipo de enfermería ante la posibilidad de NAVM, según se describe en la literatura científica. Utilizando una metodología de revisión bibliográfica integradora, se analizaron 87 artículos, de los cuales 21 fueron seleccionados para el estudio. La investigación destaca que las directrices y los protocolos, cuando se implementan correctamente, pueden reducir significativamente la incidencia de NAVM. Las medidas preventivas eficaces incluyen elevar la cabecera de la cama, suspender la sedación diaria, una higiene bucal rigurosa y controlar la presión del balón del tubo endotraqueal. La adherencia del equipo de enfermería a estas prácticas es crucial para garantizar la seguridad del paciente y la eficacia de las medidas preventivas. La investigación enfatiza la necesidad de formación continua para los profesionales sanitarios y sugiere la creación de materiales educativos, como materiales iconográficos, para reforzar estas prácticas en los entornos diarios de la UCI. La implementación constante de estas medidas puede mejorar significativamente la seguridad del paciente y reducir los costes hospitalarios.

Descriptoros: Neumonía; Enfermería Intensiva; Respiración Artificial; Ventilación Mecánica; Cuidados Intensivos.

Resumo

Objetivou-se analisar a conduta adotada pela equipe de enfermagem diante da possibilidade de surgimento de PAVM, descrita na literatura científica. Utilizando uma metodologia de revisão integrativa da literatura, foram analisados 87 artigos, dos quais 21 foram selecionados para o estudo. A pesquisa destaca que diretrizes e protocolos, quando aplicados corretamente, podem reduzir significativamente a incidência de PAVM. As medidas preventivas eficazes incluem a elevação da cabeceira do leito, interrupção da sedação diária, higiene oral rigorosa e verificação da pressão do cuff do tubo endotraqueal. A adesão da equipe de enfermagem a essas práticas é crucial para garantir a segurança do paciente e a eficácia das medidas preventivas. A pesquisa enfatiza a necessidade de educação continuada para os profissionais de saúde e sugere a criação de materiais educativos, como iconográficos, para reforçar essas práticas no cotidiano das UTIs. A implementação consistente dessas medidas pode melhorar significativamente a segurança do paciente e reduzir os custos hospitalares.

Descriptoros: Pneumonia; Enfermagem Intensiva; Respiração Artificial; Ventilação Mecânica; Terapia Intensiva.



Introduction

Historically, before the 1920s, experiments were performed on animals with a tube inserted directly into the trachea, and the post-intubation infectious process in these animals was already being identified. Mechanical ventilation became popular in 1950 with the development of the iron lung, which later became known as the mechanical ventilator, giving great visibility to Philip Drinker, a hygienist engineer who developed the first mechanical ventilator^{1,2}.

Since then, several ventilator models have been developed, always aiming to provide the best possible care for patients, safely and responsibly. Currently, mechanical ventilation (MV) is the second most frequently performed therapeutic intervention in intensive care units, surpassed only by the treatment of cardiac arrhythmias. Although its benefits are undeniable, it is associated with multiple complications³.

Ventilator-associated pneumonia (VAP) is conceptually defined as pneumonia that occurs in patients who are on MV for more than 48 hours. The pathogenesis of VAP is related to the number and virulence of microorganisms that penetrate the lower respiratory tract beyond the patient's defenses, including mechanical, humoral, and cellular factors³.

The main form of airway penetration is microaspiration of organisms that colonize the oropharyngeal and gastrointestinal tracts. The presence of an endotracheal tube does not adequately protect airway aspirations, and when used for prolonged periods, it facilitates the microaspiration of oropharyngeal material containing bacteria into the respiratory tract. Depending on the quantity and virulence of the aspirated organisms and the patient's immune system, alveolar involvement and pneumonia may progress. Considering the unique nature of intensive care patient dependence, an additional mechanism for microorganism penetration occurs during mechanical ventilation (MV), as contact with tracheal suction tubes and water reservoirs contained in respirators for airway humidification is inevitable⁴.

VAP represents half of all hospital-acquired pneumonia cases and is estimated to affect 9 to 27% of patients on MV, being the second most common health-related infection in the ICU³.

However, the research problem lies in the following question: "How can the occurrence of VAP in the ICU be prevented?" To answer this question, we aim to analyze the

The relevance of this topic is evident in the study's results, as they will serve as a valuable tool for updating other healthcare professionals, ensuring continued education and technical development for the team. The relevance of this topic is evident in the study's results, which will serve as a valuable tool for updating other healthcare professionals. This will contribute to the continuing education and technical development of the nursing team, ensuring the implementation of evidence-based practices for VAP prevention.

Methodology

This is an integrative literature review, descriptive with a mixed approach (quantitative – qualitative) where it is possible to obtain tools for practice based on evidence and build an analysis⁵, regarding VAP in adult intensive care, which, through the publications of other authors, allows us to answer the study's guiding question. The research went through the following stages: choosing the problem, establishing the objective, research data source, and reading.

To support the study's theme, intensive care manuals and books were consulted. Data collection included a search for articles in the Virtual Health Library (VHL), LILACS (Latin American Literature in Health Sciences), Medline (Medical Literature Analysis and Retrieval System Online), Scientific Electronic Library Online (SciELO), and the Nursing Database (BDENF). The following Health Science Descriptors (DeCS) were used: "pneumonia," "nursing," "intensive care," "artificial respiration," and "mechanical ventilation" in an advanced search with the Boolean operator "AND".

The inclusion criteria for articles also included the following: full texts, Portuguese and Spanish. The selected timeframe was the last seven years (2017-2023). Duplicate articles, other integrative literature reviews, and articles that did not address the VAP strategy were excluded. Based on the exclusion criteria, the titles and abstracts of the articles were read. Based on these criteria, 87 articles were found, of which 21 were selected for this study. Articles were selected between 2022 and 2023, using the filters provided by the databases themselves.

Results and Discussion

Chart 1 presents studies selected for this synthesis.

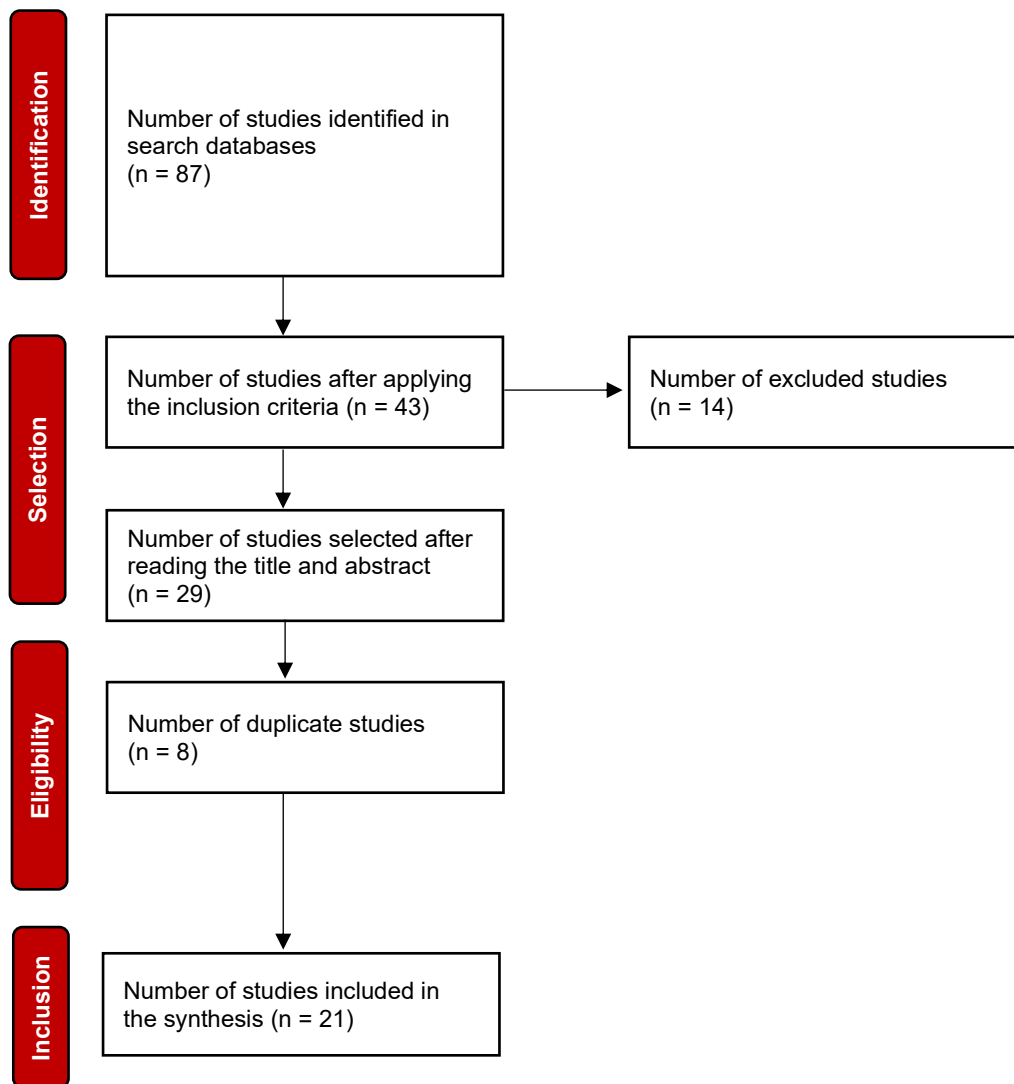
Chart 1. Selected studies. Rio de Janeiro, RJ, Brazil, 2017-2023

Authors	Title	Methodology	Year	Journal	Main Themes
KICH et al.	Cuidados de enfermagem e perfil epidemiológico de pacientes com pneumonia associada à ventilação mecânica	Observational study	2022	Rev. Epidemiol. Controle infecç	Risk factors and epidemiology of VAP.
BARROS.	Adesão ao bundle de prevenção de pneumonia associada à ventilação mecânica	Descriptive study	2019	Rev. Cuid.	Nursing team adherence to preventive measures.
BRANCO et al.	Education to prevent ventilator-associated pneumonia in intensive care unit	Integrative review	2020	Rev. Bras. Enferm.	Nursing team adherence to preventive measures.



ALECRIM et al.	Estratégias para prevenção de pneumonia associada à ventilação mecânica: revisão integrativa	Integrative review	2019	Rev. Bras. Enferm.	Effectiveness of bundles in preventing VAP.
MONTINI et al.	Adesão ao bundle para prevenção de pneumonia associada à ventilação mecânica em terapia intensiva	Descriptive study	2020	CuidArte Enferm	Effectiveness of bundles in preventing VAP.
RODRIGUES et al.	Ações de enfermagem na prevenção da pneumonia associada à ventilação mecânica: Uma revisão integrativa	Integrative review	2022	Nursing (Ed. bras. Impr.)	Nursing team adherence to preventive measures.
MACIEL et al.	Ações de enfermagem para prevenir pneumonia por ventilação mecânica na unidade de terapia intensiva: revisão	Integrative review	2017	Rev. Enferm. UFPI	Nursing team adherence to preventive measures.
FRANÇA et al.	Cuidados de enfermagem: prevenção de pneumonia associada à ventilação mecânica	Descriptive study	2021	Rev. Enferm. UFPE on line	Effectiveness of bundles in preventing VAP.
CRUZ et al.	Pneumonia associada à ventilação mecânica invasiva: cuidados de enfermagem	Descriptive study	2019	Referência	Effectiveness of bundles in preventing VAP.
COSTA et al.	Cuidados de enfermagem na prevenção da pneumonia associada à ventilação mecânica	Descriptive study	2021	Rev. Ciênc. Plur	Risk factors and epidemiology of VAP.
LIZ et al.	Cuidados multiprofissionais relacionados à prevenção da pneumonia associada à ventilação mecânica	Descriptive study	2020	Enferm. foco (Brasília)	Nursing team adherence to preventive measures.
MURATA et al.	Enfermagem em terapia intensiva	Literature review	2015	Manole	Risk factors and epidemiology of VAP.
SILVA et al.	Relação entre pneumonia associada à ventilação mecânica e a permanência em unidade de terapia intensiva	Observational study	2021	Nursing (São Paulo)	Risk factors and epidemiology of VAP.
SANTOS et al.	Fatores de risco que favorecem a pneumonia associada à ventilação mecânica	Literature review	2018	Rev. Enferm. UFPE on line	Risk factors and epidemiology of VAP.
CARDOSO et al.	Perfil dos pacientes com infecções relacionadas à assistência à saúde em unidade de terapia intensiva de um hospital público	Observational study	2020	Rev. Epidemiol. Controle infecç	Risk factors and epidemiology of VAP.
REIS et al.	Importância da higiene oral em pacientes internados em unidade de terapia intensiva	Descriptive study	2022	Rev. Soc. Cardiol. Estado de São Paulo	Risk factors and epidemiology of VAP
MELO et al.	Fatores de colaboração para redução de infecção relacionada à assistência à saúde em terapia intensiva no Nordeste	Observational study	2022	Rev. Bras. Ter. Intensiva	Risk factors and epidemiology of VAP.
ZIGART et al.	Adesão ao protocolo de pneumonia associado à ventilação mecânica	Descriptive study	2019	Rev. Enferm. UFPE on line	Nursing team adherence to preventive measures.
CARDOSO et al.	Diagnóstico e tratamento em pneumologia	Literature review	2021	Manole	Risk factors and epidemiology of VAP.
ARAÚJO et al.	Assistência de enfermagem na prevenção de pneumonia associada à ventilação mecânica: revisão integrativa	Integrative review	2021	J. Nurs. Health	Effectiveness of bundles in preventing VAP.
AGUIAR et al.	Avaliação das internações dos recém-nascidos em uma UTI Neonatal durante uma pandemia	Descriptive study	2022	Rev. Urug. Enferm	Risk factors and epidemiology of VAP.

Figure 1. Flowchart of study selection and identification according to PRISMA recommendations. Rio de Janeiro, RJ, Brazil, 2017-2023



The analysis of the selected articles focused on nursing care in the prevention of ventilator-associated pneumonia (VAP). Studies^{6,7} highlight a set of essential preventive measures, such as elevating the patient's position, discontinuing or reducing daily sedation, rigorous oral hygiene, and checking the cuff pressure of the endotracheal tube or tracheostomy. These procedures have been shown to be effective in reducing the incidence of VAP, as observed¹.

The data show that VAP occurs more frequently in men, with an average age of 55 years². Factors that aggravate the situation include advanced age, nutritional and oxygenation status of the patient, severity of the disease, level of consciousness, excessive use of antimicrobials, prolonged intubation, contamination during aspiration, presence of comorbidities and accumulation of secretions in the oropharynx^{3,4}. Advanced age and comorbidities are highlighted as critical factors⁸.

It is noted that preventive measures, such as elevating the head of the bed between 30 and 45 degrees, are recommended to avoid bronchoaspiration, especially in patients with enteral nutrition⁹. Interrupting or reducing daily sedation allows us to assess whether the patient can

ventilate spontaneously, facilitating early extubation and reducing the time on mechanical ventilation, thus reducing the risk of VAP¹⁰.

Oral hygiene, using antiseptics such as 0.12% chlorhexidine gluconate, is essential, as it significantly reduces the number of microorganisms in saliva, inhibiting the growth of pathogenic bacteria and yeast¹¹. Checking the cuff pressure of the orotracheal or tracheostomy tube is crucial to prevent microaspiration of subglottic secretions, which can lead to VAP, in addition to preventing local ischemia caused by hyperinflation¹².

Studies show that VAP can prolong a patient's stay in the intensive care unit (ICU), increase hospital costs, and decrease patient safety^{8,13}. Nursing teams' adherence to preventive guidelines and protocols is often low, compromising the effectiveness of preventive measures. This highlights the need for ongoing and permanent education for healthcare professionals, ensuring the application of evidence-based practices^{14,15}.

Technological advances and equipment modernization have made the work of healthcare professionals easier, improving outcomes and therapeutic response. Consistently implementing these preventive

measures can significantly reduce the incidence of VAP, promoting patient safety and efficient healthcare^{2,9}.

Authors⁶ emphasize that the use of care bundles, which are sets of evidence-based practices, has been shown to be effective in reducing the incidence of VAP. These practices include elevating the patient's position, discontinuing daily sedation, and oral hygiene, among others. The correct and continuous implementation of these measures is essential to ensure effective VAP prevention⁹.

Furthermore, study⁷ highlights the importance of nursing staff adhering to preventive practices. Lack of adherence can significantly compromise the expected results in preventing VAP. Therefore, it is essential that nursing professionals receive adequate and ongoing training to ensure the effective implementation of these preventive practices^{7,14}.

Continuing education for nursing professionals is essential to maintaining quality care and patient safety. Authors suggest that periodic training and refresher programs can help ensure that preventive practices are followed correctly. Creating educational materials, such as iconographic materials, can be a useful tool to reinforce these practices in the daily routine of the ICU¹⁵.

Finally, studies^{8,13} show that implementing preventive practices can significantly reduce the incidence of VAP, improve patient safety and reduce hospital costs. However, low adherence to recommended practices remains a challenge that needs to be overcome. Continuing education and implementing evidence-based measures are essential to improving outcomes and safety for patients on mechanical ventilation.

Final Considerations

Preventing ventilator-associated pneumonia (VAP) is a significant challenge in intensive care units due to its serious consequences for patients. This final project highlighted the importance of preventive measures and adherence to established guidelines and protocols by the nursing team. The research results showed that consistent and correct implementation of preventive measures, such as elevating the patient's position, discontinuing daily sedation, rigorous oral hygiene, and monitoring cuff pressure, results in a significant reduction in the incidence of VAP. However, low adherence among nursing staff to these preventive practices was identified as a crucial obstacle to their effectiveness.

Therefore, the need for ongoing and permanent education for healthcare professionals is emphasized. Regular training and educational materials, such as visual aids, are recommended to reinforce the importance of preventive practices in the daily routine of the ICU.

Furthermore, modernizing equipment and using care bundles, which are sets of evidence-based practices, have proven effective in preventing VAP. Adherence to these practices, however, requires ongoing commitment from the nursing team, as well as institutional support to ensure patient safety and efficient care.

It is concluded that the consistent implementation of preventive measures can promote patient safety, reduce the incidence of VAP, and, consequently, lower hospital costs. Therefore, continuing education and adherence to evidence-based practices are essential to improve outcomes in the treatment of mechanically ventilated patients in intensive care units.

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