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Incidence of hospital - acquired in pneumonia in intensive care patients / Incidencia de neumonía intrahospitalaria en pacientes de terapia intensiva

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ABSTRACT

Introduction: hospital-acquired pneumonia (HAP) is a serious infection that appears after 48 hours of hospital admission, with high morbidity and mortality in intensive care units (ICU). This retrospective study at the Sanatorio Güemes, from October 2023 to March 2024, analyzes the incidence of NIH in patients over 18 years of age with comorbidities with those without a history. Data collection was carried out through medical records. The findings highlight the need for rapid diagnostic methods and new antibiotics due to microbial resistance. The aim is to understand the risk factors and optimize the management of NIH in critically ill patients.
Method: analytical, observational and retrospective work; whose study variable is longitudinal.
Results: results from 14 patients were included with data from their medical records with data relevant to this study, as well as Pubmed bibliography from the last 5 years.
Conclusions: the combination of literature data and patient analysis highlights the complexity of the NIH and highlights critical areas for future research. The development of rapid diagnostic methods, new antibiotics and a better understanding of comorbidities could significantly improve management and outcomes for patients. With the integration of new technologies and personalized approaches, it is possible to optimize the prevention and treatment of this serious condition.
Keywords: Pneumonia; Intense Care; Prevalent Pathogens.

RESUMEN

Introducción: la neumonía intrahospitalaria (NIH) es una infección grave que aparece tras 48 hs de ingreso hospitalario, con alta morbimortalidad en unidades de cuidados intensivos (UCI). Este estudio retrospectivo en el Sanatorio Güemes, de octubre 2023 a marzo 2024, analiza la incidencia de NIH en pacientes mayores de 18 años con comorbilidades con aquellos sin antecedentes. La recolección de datos se realizó mediante historias clínicas. Los hallazgos destacan la necesidad de métodos diagnósticos rápidos y nuevos antibióticos debido a la resistencia microbiana. Se busca entender los factores de riesgo y optimizar el manejo de NIH en pacientes críticos.
Método: trabajo analítico, observacional y retrospectivo; cuya variable de estudio es longitudinal.
Resultados: se incluyeron 14 pacientes con datos relevantes, como así también, bibliografía de Pubmed de los últimos 5 años.
Conclusiones: la combinación de datos bibliográficos y análisis de pacientes resalta la complejidad de la NIH y subraya áreas críticas para futuras investigaciones. El desarrollo de métodos diagnósticos rápidos, nuevos antibióticos y una mejor comprensión de las comorbilidades podría mejorar significativamente el manejo y los resultados para los pacientes. Con la integración de nuevas tecnologías y enfoques personalizados, es posible optimizar la prevención y tratamiento de esta grave condición.

Palabras clave: Neumonía; Cuidados Intensivos; Patógenos Prevalentes.

INTRODUCTION

According to the definitions of the Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS), hospital-acquired pneumonia is diagnosed when it occurs more than 48 hours after hospital admission.[1] It is a severe infection in critically ill patients, with a high morbidity and mortality rate in intensive care units (ICUs), with an attributable incidence ranging from 20 % to 50 %. It is considered the leading cause of death in patients.

Risk factors and complications to consider include advanced age, severity of underlying disease, previous exposure to invasive procedures, and duration of exposure to broad-spectrum antibiotics. The most common complications include acute respiratory failure, septic shock, acute respiratory distress syndrome (ARDS), and multiple organ failure. According to the texts and bibliographies consulted, broad-spectrum empirical therapies are mentioned, based on the disease diagnosis, with subsequent adjustments based on clinical response and cultures, considering the possibility of other nosocomial infections and antimicrobial resistance.

That said, the following question arises: Do patients admitted to the intensive care unit with underlying lung disease, compared to patients with no history of disease, have the exact incidence of nosocomial pneumonia caused by the same microorganisms in this hospital?

Current approaches propose that the diagnosis be multimodal, including clinical evaluation, laboratory and imaging tests, and respiratory samples to identify specific microorganisms. Over the years, diagnostic and treatment algorithms have been established, whether empirical or targeting specific agents.[2] Yet, the diagnosis and treatment of NIH remain deficient in healthcare settings due to ongoing updates in the literature.[3,4]

METHOD

An observational, retrospective study was conducted of patients admitted to the intensive care unit at the Güemes sanatorium between October 2023 and March 2024. Primary data was collected from medical records, images, and laboratory studies performed during each patient's hospital stay.

Publications were also used to demonstrate the relationship between patients diagnosed with hospital-acquired pneumonia in intensive care and their risk factors.

Inclusion Criteria

- Adult patients aged 18 years or older.
- Admitted to intensive care with a diagnosis of nosocomial pneumonia.
- Presenting at least one risk factor, such as infections or pathogen isolation in cultures.
- Patients with underlying respiratory disease.

Exclusion Criteria

- Patients under 18 years of age.

This study was conducted in a private hospital setting at the Sanatorio Güemes[5] located in

the geographical center of the Autonomous City of Buenos Aires (Argentina).

The hospital has an installed capacity of 40 000 m2 and treats approximately 40 000 patients per month. It has 610 beds, 210 of which are for high-complexity cases. It has a staff of about 1100 doctors and is a teaching hospital with an average of 290 residents. Specifically, the intensive care unit has 46 individual rooms (distributed across four sectors), making it one of the largest in Argentina.

It has a single independent monitoring center, which allows direct visualization of the patient, and PYXIS terminals for medication delivery (an automated medication system) that control delivery and prioritize patient safety.[6]

Intervention and Instrument(s) for Data Collection

PubMed was used to search for information. For the observational part of the study, retrospective information was collected from the Güemes Sanatorium, analyzing the medical records of patients diagnosed with nosocomial pneumonia, either as the initial cause of admission to intensive care or as a complication of other pathologies upon admission.

For the observational part, an Excel spreadsheet was used to collect relevant information on each patient (age, date of admission to the ICU, date of diagnosis of nosocomial pneumonia, drug sensitivity and resistance, etc.) with the clinical variants of each patient to evaluate similarities and differences.

For the analytical evaluation, references were drawn from the PubMed bibliography and websites that reported the findings and statistics on hospital-acquired pneumonia in intensive care units were used as references.

RESULTS

The search for results was conducted manually. First, a bibliographic search was conducted through PubMed, filtering for reviews from the last five years.

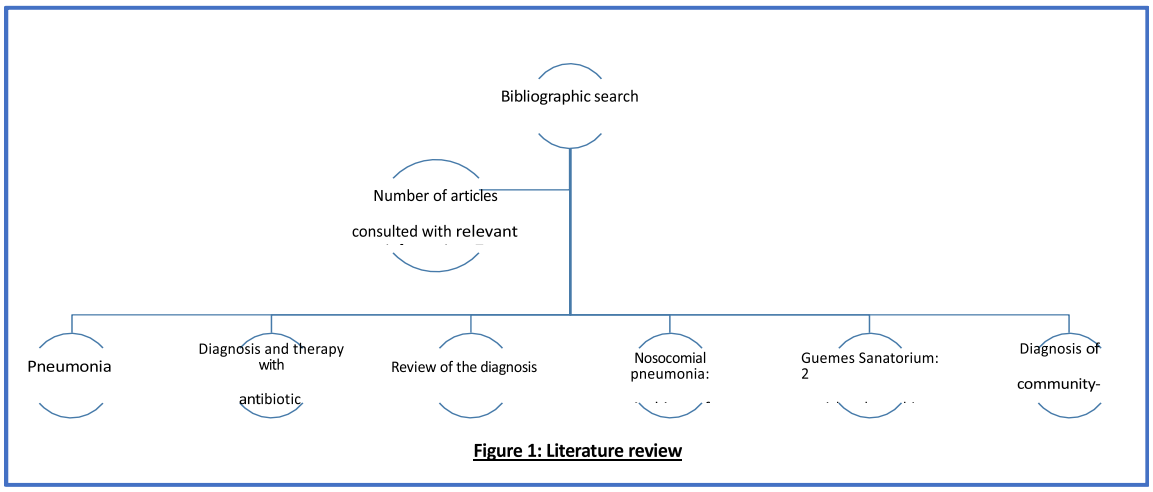

Figure 1. Literature review

Table 1. Observational and retrospective study

Patient	Age	Gender	Admission to icu	Diagnosis	Symptoms	Pathogen	Treatment	Comorbidity	Complications
1	55	F	2/10/2023	Respiratory failure in the context of NAC in a patient hospitalized for tracheoesophageal fistula tracheoesophageal	Fever 38,5°C, cough, serous secretions due to tracheostomy, dyspnea CF IV, serous and malodorous secretions, tachypnea, and use of respiratory muscles.	Klebsiella pneumoniae	PTZ - Clarithromycin - Oseltamivir	Esophageal cancer with pulmonary complications - Feeding via jejunostomy- Bilateral NAC due to SARS COV 2	Bacteremia due to Pseudomonas aeruginosa-septic shock- VMI- cardiorespiratory arrest- death
2	69	M	10/19/2023	Respiratory failure secondary to NIH	Anemia, thrombocytopenia, fever, hypotension, respiratory failure Type I,	S. Pneumoniae	PTZ- Vancomycin	Smoker- hemothorax-COPD- TB	EAP and HDA
3	82	M	11/15/2023	NIH associated with SARS	Cough, fever, desaturation 88 %, drowsy and tachypneic	SarsCov2	PTZ	Atrial fibrillation- HF- Dbts II- hypothyroidism- sedentary lifestyle- dyslipidemia- obesity- institutionalized- fluctuation in orientation	Acute renal failure-Mild TBI due to fall from own height height- ITU associated with confusional syndrome
4	62	F	11/28/2023	UTI + NAC	Sepsis affecting the skin and soft tissues, dyspnea CF III	S. Aureus	PTZ -Vancomycin	Amyotrophic lateral sclerosis amyotrophic, multiple bronchopneumonia with respiratory failure, smoker, institutionalized in a third-level facility	IRA -Gastrostomy with evidence of leakage into subcutaneous tissue with indication for surgical resolution

5	65	M	12/2/2023	Acute respiratory failure type I secondary to NAC	Mucopurulent sputum , fever 39°C, dyspnea CF III,	E. Fecalis	Levofloxacin-Vancomycin	HTA- COVID pneumonia (2020)-Angina Vasospastic-Dyslipidemia-Cholecystectomy-Ex-smoker smoker-Penicillin allergy	Pleural effusion parapneumonic - CAFO requirement-
6	85	M	5/1/2024	Left lung decortication left due to empyema + hemothorax + NIH	hypoventilation in left base, tendency to drowsiness,	S. Pneumonia and	AMS complies + then Meropenem, tigecycline, and colistin	Nutritional support feeding - ARF	Tachypnea-hypotension-bibasal hypoventilation-left-sided secretion mobilization-septic shock with respiratory focus respiratory shock due to Klebsiella
7	20	F	1/31/2023	NIH (due to prolonged hospitalization)	Increased secretions, desaturation	E. Fecalis	AMS-Clarithromycin	Chronic encephalopathy secondary to cytomegalovirus Gastrostomy due to swallowing disorder - Home oxygen therapy at 3 liters - Severe developmental delay-epilepsy-neuropathic scoliosis- bilateral hip dislocation bilateral	KPC (+) swab - ARM

8	70	F	2/15/2024	Sensory impairment and respiratory failure Respiratory	Respiratory distress, central cyanosis, thoracoabdominal dissociation, sensory impairment, CPR for 4 min-	E. coli MS - AT usual flora	PTZ-Clarithromycin	Hypothyroidism-Osteoarthritis-Spinal surgery-Home hospitalization with oxygen and nocturnal CPAP- Previous hospitalization within 90 days	NAC with obstructive hypopnea (NIH) - IMV
9	55	F	2/28/2024	NIH	desaturation, dyspnea, accessory muscle use accessory muscles, fever 39,5°	SarsCov2	AMS-Corticosteroid therapy	Breast cancer—bone and liver metastasesliver	Type I ARI-bacterial superinfection-
10	50	F	12/3/2024	Respiratory failure due to requirement for cafo due to NAC and TBC	Oral intolerance - nausea - vomiting - weight loss -III/IV dyspnea and night fever	Influenzae vs. Jiroveci	TMS - PCP-Levofloxacin-Rifampicin - Isoniazid - Pyrazinamide	HIV with ARV discontinuation - TB with treatment discontinuation - Bronchiectasis - Depression - Appendectomy	Sustained hypotension-Regular respiratory mechanicsdue to superficial tachypnea - Enteral feeding as required
11	31	F	3/12/2024	Bilateral pneumonia	Dry cough, functional class II dyspnea with progression to CF IV, desaturation, tachycardia, ground-glass infiltrates, respiratory deterioration and need for CAFO.	Influenza	PTZ Clarithromycin	Diffuse B-cell lymphoma - Superior vena cava síndrome-	-

12	87	M	3/16/2024	Exacerbated COPD secondary to NIH	Fever, productive cough, asthenia, adynamia, desaturation, crepitations, and bibasal hypoventilation	Influenza	Levofloxacin-Corticosteroid therapy	HTA- Ischemic stroke-Aortic valve replacement-Pulmonary fibrosis-HF- COPD-Penicillin allergy	
13	46	F	3/18/2024	Acute respiratory failure secondary to pneumonia	Dyspnea - fair general condition - fair air entry due to hypoventilation	Influenza A	PTZ -Clarithromycin - Oseltamivir	Obesity - Myelodysplastic syndrome	VMI with poor response, requiring mechanical intubation, ARF due to infectious process, septic shock septic shock
14	75	M	19/3/2024	Respiratory failure secondary to COPD in the context of NAC bilateral	Progressive dyspnea associated with , impaired consciousness, respiratory distress, severe hypoxemia, tachycardia, and peripheral cyanosis, 38°C,	Influenza	Clarithromycin - Oseltamivir - PTZ	HTA- Dyslipidemia-severe smoker-COPD with poor adherence to treatment - Type 2 diabetes - Multifactorial CRF -Hepatic steatosis—Coronary heart disease and depressive disorderdepressive disorder	SDRA-Cardiogenic shock - mixed shock (septic/ cardiogenic) - ARM

The search yielded seven articles that provided relevant and significant information for the purpose of this study. This data collection was carried out in an Excel spreadsheet, which includes the analysis of 14 patients who met the inclusion criteria for this study. Patients diagnosed with hospital-acquired pneumonia covering the following aspects:

1. Age: age range of patients
2. Gender: distribution of patients by gender
1. Date of admission: to the closed unit
2. Diagnosis: details of the diagnosis at the time of admission to the intensive care unit
3. Symptoms: upon admission to the institution
4. Isolated pathogen: a type of pathogen identified in patients
5. Treatment: methods used for each patient
6. Comorbidities: pre-existing conditions affecting the patient's health
7. Complications that arose during hospitalization and/or secondary to the initial diagnosis.

This analysis provided a detailed, organized overview of the clinical profile and management of patients with hospital-acquired pneumonia, helping better to understand demographic characteristics, comorbidities, and treatment outcomes.

DISCUSSION

Hospital-acquired pneumonia (HAP) is a lung infection that develops 48 hours after hospital admission or up to 90 days after discharge. The main risk factors include orotracheal intubation and aspiration of microorganisms that colonize the oropharynx or upper digestive tract. Several of the authors consulted agree that the most common pathogens are Pseudomonas aeruginosa and Staphylococcus aureus.

In the retrospective analysis conducted at the Sanatorio Güemes, data were collected from the 14 medical records of patients who met the evaluation criteria, and the most commonly isolated pathogen was Influenza. Staphylococcus aureus was isolated in only one patient. NIH has significant consequences for the patient and the healthcare system, including high mortality and prolonged hospital stays.

The effectiveness of treatment depends on the timeliness and appropriateness of the antibiotic regimen, with a significant risk of inadequate empirical therapy due to pathogen resistance. Empirical treatment should be initiated immediately, without waiting for microbiological test results, and should be appropriate and adequate.

Immediate empirical therapy is crucial, and the literature highlights the importance of adjusting treatment according to microbiological results, a practice also observed in the patients analyzed. As assessed in the observational study, 100 % of patients were treated empirically, and 13 of 14 patients received cycles of combined antibiotic doses (only one patient was treated with a single drug, which would be contraindicated according to the literature consulted). The primary drug of choice was Piperacillin-Tazobactam (PTZ), used in 8 of 14 patients, and the second choice was Clarithromycin in 6 of 14 patients. Growing antibiotic resistance underscores the need to develop new antimicrobial agents.

Hospital-acquired pneumonia has a higher mortality rate than community-acquired pneumonia and requires a more complex empirical therapeutic approach because of the

presence of resistant pathogens. Specific risk factors for NIH include recent hospitalization or any other type of third-level institutionalization. Patients of various ages were evaluated, with a balanced gender distribution. There is a high prevalence of comorbidities such as diabetes, cardiovascular disease, COPD, smoking, lung conditions (non-COPD), and renal failure. Of 100 % of only 21,4 % of the patients evaluated did not detail any of these prevalent comorbidities in their medical history. Comorbidities increase the complexity of NIH management and are associated with worse outcomes, as evidenced in the patients analyzed and in the literature reviewed. The most common pathogenesis is aspiration of microorganisms, including exogenous or endogenous pathogens.

The diagnosis is based on the appearance of new pulmonary infiltrates, dyspnea, fever, purulent secretions, and leukocytosis. In mechanically ventilated patients, these criteria are less specific.

The diagnostic methods described in the literature and those used in patients are consistent, underscoring the need for faster, more accurate methods. Confirmed diagnosis of NIH is made using clinical and microbiological criteria. A variety of pathogens are recognized, including multidrug-resistant bacteria, with Pseudomonas aeruginosa and Staphylococcus aureus predominating, according to the authors' conclusions based on the literature over the last 5 years.

The incidence and risk factors for NIH commonly develop in patients with the most common complications, including sepsis, respiratory failure, and prolonged hospital stay. This is consistent with the findings in patients at the Sanatorio Güemes, as most patients suffered complications, the most recurrent being the need for supplemental oxygen or even invasive mechanical ventilation due to hemodynamic decompensation or poor response to treatment.

Given all of the above, the following needs for further research can be established:

1. Development of Rapid Diagnostic Methods: it is crucial to develop rapid, accurate diagnostic methods to reduce unnecessary use of broad-spectrum antibiotics.
2. New Antibiotics: there is an urgent need to research and develop new antibiotics that are effective against multidrug-resistant pathogens.
3. Studies on Comorbidities: studies are needed to explore how different comorbidities influence NIH risk and management to personalize treatments.

We can consider several general aspects in relation to this issue:

- Infection Prevention and Control: Implementing strict infection control measures and optimizing hospital hygiene are essential to reduce the incidence of NIH.
- Personalized Medicine: Personalized medicine, based on the patient's genetic and microbiological profile, could revolutionize the treatment of HAI, providing more effective therapies and reducing complications.
- Economic Impact: Reducing the incidence of NIH and efficiently treating existing cases could significantly reduce hospital costs and improve patients' quality of life.

BIBLIOGRAPHIC REFERENCES

1. Antoni Torres, José Barberán, Adrian Ceccato, Ignacio Martin-Loeches, Miguel Ferrer, Rosario Menéndez, David Rigau. Neumonía intrahospitalaria. Normativa de la Sociedad Española de Neumología y Cirugía Torácica (SEPAR); 2020. https://www.sciencedirect.com/science/article/abs/pii/S030028962030041

2. Rachina S.A., Fedina LV, Sukhorukova MV, Sychev IN, Larin ES, Alkhlavov A. Diagnóstico y terapia con antibióticos de la neumonía nosocomial en adultos: de las recomendaciones a la práctica real; Terapevticheskii arkhiv;2023. https://pubmed.ncbi.nlm.nih.gov/38158959/

3. Koulenti, Despoinaa; Zhang, Yuchic; Fragkou, Paraskevi Cd. Revisión del diagnóstico de neumonía nosocomial. Opinión actual en cuidados críticos; octubre de 2020. https://pubmed.ncbi.nlm.nih.gov/32739969/

4. José Blanquer, Javier Aspa, Antonio Anzueto, Miguel Ferrer, Miguel Gallego, Olga Rajas, Jordi Rello, Felipe Rodríguez de Castro, Antonio Torres. Normativa SEPAR: neumonía nosocomial, Archivos de Bronconeumología, Volume 47, Issue 10;2011. https://www.sciencedirect.com/science/article/abs/pii/S0300289611002146

5. Sanatorio Güemes. Buenos Aires.2024. https://sitio.sg.com.ar/

6. Paul G. Mariani, MD Tze Shien Lo, MD. Neumonía adquirida en la comunidad: tratamiento. Revisión de la Junta de Enfermedades Pulmonares; septiembre de 2019. https://www.mdedge.com/content/community-acquired-pneumonia-treatment

FINANCING

None.

CONFLICT OF INTEREST

None.

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