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ORIGINAL RESEARCH

Prevalence of complicated pneumonia in hospitalized pediatric patients at José Carrasco Arteaga Hospital, January 2014 to December 2017.

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Abstract

Introduction: Complicated pneumonia represents a health problem in the pediatric population. An acute respiratory disease, it is the main cause of hospital morbidity and mortality in this population, requiring timely diagnosis and treatment. The objective of this study was to determine the prevalence of complicated pneumonia in hospitalized patients of the pediatric service of the Hospital José Carrasco Arteaga in the city of Cuenca from January 2014 to December 2017.

Methodology: This is a cross-sectional descriptive study of Pediatrics and Pediatric Intensive Care patients from January 2014 to December 2017. Descriptive statistics were used for the analysis and the data were tabulated using SPSS 15.0 software.

Results: The prevalence of complicated pneumonia was 28.8%. There was a predominance of males (56.4%), the largest age group was 0 to 3 years (43.6%), and the population came mostly from urban areas (58.9%). Malnutrition was found in 51.1%, and the most common comorbidities were respiratory, at 12.4%. Most (54.6%) required hospitalization for 5–9 days, and the most widely used antibiotics were beta-lactamic (85.8% of cases). The most frequent complication was bacteremia (43.2%) and mortality reached 8.1%.

Conclusions: The prevalence of complicated pneumonia was high, with a predominance of bacteremia treated with beta-lactams; the majority of patients were male, under 3 years of age, and had malnutrition.

Keywords: Pneumonia; Pneumonia, Staphylococcal; Child; Intensive Care Units, Pediatric; /complications.

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Introduction

Community-acquired pneumonia (CAP) represents the leading cause of infant death worldwide and is a leading cause of morbidity in developed countries. The World Health Organization (WHO) reports that CAP is responsible for approximately 19% of deaths in children under 5 years of age [1].

The Spanish Association of Pediatrics defines CAP as acute infection of the lung parenchyma. It is characterized by fever and/or respiratory symptoms, together with pulmonary infiltrates in the chest X-ray. The etiological agent depends on age: in children under 3 weeks, the agent is characteristic germs of the birth canal; from 3 weeks to 3 months, respiratory viruses are common; from 3 months to 4 years, the most frequent agents are viruses, followed by *Streptococo pneumoniae*; over 5 years, the most significant are *Mycoplasma pneumoniae* and *Streptococo pneumoniae* [2]. Typical pneumonia, the cause of the highest morbidity and mortality, is produced by different bacteria (*Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Klebsiella pneumoniae*) [3].

Streptococcus pneumoniae, the main pathogen in typical pneumonia, has many variations compared to other bacteria. In developing countries in particular, it is responsible for most pneumonia complications. In addition, instances of methicillin-resistant *Staphylococcus aureus* pneumonia appear that, together with *Streptococcus pyogenes*, cause very aggressive pneumonia with rapid development of empyema, abscesses, and sepsis.

The variations among the different types of pneumonia lie in the findings produced by the microorganism that caused them. X-ray images that resemble air pockets typically point to Staphylococcus, especially in the upper lobe, while *Klebsiella* greatly compromises the lower lobe, with expectoration resembling "currant syrup" [4].

Complicated pneumonias constitute an important group within admissions to our hospitals with thoracic pathology and present as complex bronchopulmonary and pleural lesions. When pneumonia has not been limited to the lung parenchyma but has spread to the pleurae and empyema occurs, the clinical course and prognosis are markedly modified. This brings a challenge for its correct management, since there is no unification in the classification criteria, which leads to a delay in decision-making as well as in timely and adequate treatment. The major complications of pneumonia are bronchopleural fistula, necrotizing pneumonia, pneumothorax, and empyema [5].

There is now general concern among pediatricians about the increase in cases of complicated pneumonia. This is not exclusive to developing countries but applies to the population in general, highlighting the importance of developing studies that provide real values on the prevalence of this type of pneumonia, which can become complicated and even cause death.

Population and methods

Type of study

Descriptive cross-sectional study

Study area

The study was carried out from January 1st 2014 to December 31, 2017 in the pediatric and PICU area of the "José Carrasco Arteaga" Hospital, in Cuenca-Ecuador.

Study universe

A non-probabilistic sampling was performed. All patients diagnosed with pneumonia in the institutional pediatric area were considered.

Variables under study

Complicated pneumonia and type, age, sex, residence, nutritional status, overcrowding, respiratory, cardiac, renal or other comorbidities, days of hospitalization, use of oxygen and mechanical ventilation, surgeries and procedures performed, antibiotic therapy, hospitalization room, and condition upon discharge.

Inclusion criteria

Hospitalized patients with a diagnosis of pneumonia or who developed in-hospital pneumonia during their hospitalization, aged between 0 and 15 years, 11 months, and 29 days, and who presented any type of complication associated with pneumonia.

Exclusion criteria

Incomplete records.

Methods, techniques, and instruments

After authorization by the directors of the "José Carrasco Arteaga" Hospital, the data from the clinical history that appeared in the AS400 system and in a form designed by the author was collected. Assessments of nutritional status were carried out using standardized WHO curves. With regard to overcrowding, the overcrowding index used internationally was taken as a reference.

Analysis of data

Once the data were collected, they were codified and entered into a database in the SPSS 15.0 system. Frequencies and percentages were obtained for qualitative variables such as sex, residence, exposure to family smoking, nutritional status, overcrowding, comorbidities, type of complication, use of oxygen and mechanical ventilation, procedures and surgeries performed, antibiotics received, hospitalization room, and condition at discharge. Quantitative variables such as age, weight, height, and days of hospitalization were transformed into qualitative variables for tabulation. To determine the prevalence of complicated pneumonia, the total number of patients with complications of pneumonia was divided by the total number of hospitalized patients diagnosed with pneumonia in the same period of time.

Results

A total of 282 patients were included in the study. They were predominantly male and of urban origin, with a prevailing age of 0–3 years (see Table 1).

The most frequent complication was bacteremia, followed by empyema, with a minimal proportion of abscesses (see Table 2).

Prior to admission to the Intensive Care Unit, a large proportion of patients remained hospitalized for 5 to 9 days in the general ward. Most of the patients were put on oxygen therapy, its use being more frequent between days 1 and 4. A quarter of the population required respiratory support through mechanical ventilation (see Table 3).

Invasive procedures were not performed in most of the population. For patients who underwent procedures, the majority received thoracentesis. Surgeries were performed in 10.6%; of them, videothoracoscopy was the most frequent (see Table 4).

Malnutrition was the most prevalent nutritional state. Comorbidities were presented in a low percentage, the most prevalent being cardiac-related (see Table 5).

Table 1 Demographic variables of the studied group.

Variable	Frequency n=282	Percentage
Sex		
Male	159	56.4%
Female	123	43.6%
Age (years)		
0-3	153	54.2%
4-6	94	33.3%
7-10	29	10.2%
10-14	6	2.1%
Place of residence		
Urban	166	58.9%
Rural	116	41.1%

Table 2 Type of complications

Complications	Frequency n=282	Percentage
Bacteremia	122	43.2%
Empyema	68	24.1%
Pleural Effusion	58	20.5%
Pneumothorax	20	7.1%
Fistulas	12	4.3%
Abscesses	2	0.7%

Table 3 Hospital stay variables and need for oxygen therapy

Variable	Fequency n=282	Percentage
Days of hospitalization		
0-4	39	13.8%
5-9	154	54.6%
≥ 10	89	31.5%
Place of hospitalization		
Joint general hall	232	82.3%
Isolation	1	0.4%
Intensive care unit	49	17.3%
Need for oxygen therapy		
Yes	282	100%
Days of oxygen use		
1-4	136	48.2%
5-9	108	38.2%
≥ 10	38	13.4%
Mechanical ventilation requirement		
Yes	57	20.2%
No	225	79.8%

Table 4 Hospital procedures & surgeries

Variables	Frequency n=282	Percentage
Type of procedure		
Thoracentesis	21	7.4%
Chest tube placement	19	6.7%
Without procedures	242	85.9%
Type of surgery		
Video thoracoscopy	18	6.4%
Decortication	8	2.8%
Lobectomy	4	1.4%
Without intervention	252	89.4%

Table 5 Comorbidities and nutritional status of the patients by sex

Variables	Frequency n=159 (%) Male	Frequency n=123 (%) Female
Nutriotional condition		
Malnutrition	82 (51.6%)	62 (50.4%)
Normal	73 (45.9%)	59 (48.0%)
Overweight	4 (2.5%)	2 (1.6%)
Overcrowding		
Yes	26 (16.4%)	23 (18.7%)
No	133 (83.6%)	100 (81.3%)
Comorbidities		
Cardiac	19 (11.9%)	15 (12.2%)
Respiratory	17 (10.7%)	18 (14.6%)
Renal	4 (2.5%)	4 (3.3%)
Other	1 (0.6%)	0 (0%)
Without comorbidities	118 (74.2%)	86 (69.6%)

Antibiotic therapy administered

The most widely used antibiotics were beta-lactams, which were prescribed for 82.6% of patients, followed by macrolides for 7.8%, and carbapenems for 6.4%; the least used were aminoglycosides, prescribed for 3.2% of patients.

Discharge condition

Mortality was evidenced at 8.1% in the study.

Discussion

The prevalence of complicated pneumonia in the pediatric units was 28.8%, which is in line with a study carried out in Chile that reported an occurrence of between 20% and 40%, while research at the University Hospital of Barcelona indicated 1% prevalence in pneumonia acquired in the community, which increased to up to 40% in the hospital environment. In the Pepe Portillo Pediatric Hospital of Cuba, in 2016, a prevalence of 51.8% of complicated pneumonia among those admitted to the intensive care unit was reported. The significant difference with respect to the European study may be due, among other reasons, to the lack of protocols in our setting for the effective and timely treatment of complications of pneumonia [6–8].

In this study, it was observed that complicated pneumonia was more frequent in males than in females, as it was in the study carried out in Cuba in 2016, which found a predominance of males in cases of complicated pneumonia. It is believed this may be due to the genes that determine the amount of IgM located on the X chromosome, which indicate that the presence of a single X chromosome increases susceptibility to infections [6].

Complicated pneumonia was concentrated in the age group 0 to 3 years, similar to the findings of Rodríguez Cutting et al (2018), who stated that respiratory infections continue to be an important health problem in children under 5 years of age in developing countries and who reported a higher frequency in the 1- to 4-year-old age group, which is possibly related to immune system immaturity [9].

The majority of the population, both male and female, comes from urban areas; this is related to the environmental pollution generated in cities, the exposure to large circles of people, and to situations of self-medication and pharmacy visits. Without prior medical evaluations, we can thus make comparisons with the study carried out in Cuba in 2018 and see similarity in the results regarding the areas from which patients come [9].

It is observed that about half of the population has altered nutritional status, malnutrition being the most frequent and observed more in girls than in boys. This is similar to results from a Cuban study, which reported that 44% presented with malnutrition. It is known that by not having an adequate protein–calorie reserve, the child becomes vulnerable to infections [6].

Regarding overcrowding, it can be observed that more than two-thirds of the population do not live in crowded conditions, which is consistent with two 2018 studies carried out in different hospitals in Cuba [10].

About two-thirds of the population does not have comorbidities; in the population that does have comorbidities, it can be observed that the most frequent are respiratory. This aligns with a 2016 study in Cuba, where it was observed that the most common associated diseases were respiratory pathologies,

possibly making patients more vulnerable to contagion from infectious pathologies, given their compromised immune systems [6].

This study shows that the most frequent length of hospitalization was between 5 and 9 days and that more than two-thirds of the population entered the general ward, finding similarity with a 2018 study in Peru indicating a predominance of 4–6 days of hospitalization. These data differ from what was reported in 2016 in Paraguay, where an observational, descriptive cross-sectional study was carried out among schoolchildren aged 5 to 10 years; 69% were hospitalized between 11 and 15 days. It should be emphasized that the hospital stay was not prolonged despite complications in most patients, possibly related to timely or adequate management, with the consequent resolution of the complication [11, 12].

In our study, the most widely used antibiotics were beta-lactams, followed by macrolides. Similar data are observed in the study carried out by Carranza in Peru in 2018. The 2013 consensus of the Cuban Society of Pediatrics was to use third-generation cephalosporins; the same medication was used in more than half of the patients reported on by Ardisana Cruz and others [12, 13].

The most frequent complication in patients with complicated pneumonia within the pediatric department of the José Carrasco Arteaga Hospital was bacteremia, followed by empyema, with a minimal proportion of abscesses, which is related to the 2016 study in Havana that reported lung abscess among frequent complications. However, this data does not coincide with the 2016 Paraguay study by Vera and Florentín, whose most frequently found complication was pleural effusion at 76% [11].

In this research, it was reported that surgeries were performed in few patients, with videothoracoscopy the most frequent, but at a lower percentage than that reported in Havana 2017, where the majority required pleurotomy and, to a lesser extent, lung resection [12]. According to the work carried out at the Hospital Clínico Regional Valdivia, it was determined that videothoracoscopy is the technique of choice after the presentation of complications such as pleural effusion or septations following pneumonia [14].

It was observed that, of the population that had severe pneumonia, about a tenth (8.1%) died, in line with what was reported in 2017 in Havana, where there were nine deaths (5.92%) [13].

Conclusions

A high prevalence of complicated pneumonia was found in hospitalized patients with respiratory disease in the pediatric service of the José Carrasco Arteaga Hospital. Males were the most affected, as were those between 0 and 3 years of age; the majority had malnutrition, and the most common associated pathology was respiratory. Most of the patients remained hospitalized for 5–9 days, a quarter required mechanical ventilation, and the most widely used antibiotic was beta-lactam. A small number of patients required invasive procedures and surgeries, with thoracentesis and videothoracoscopy the most common. The most common complication was bacteremia and a mortality of 8.1% was observed.

Abbreviations

CAP: Community-acquired pneumonia WHO: World health organization.

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Authors' contributions

VKSO: Research idea, data collection, article writing, statistical analysis, editorial corrections.
GPGP: Research idea, study design, critical analysis, research direction.
All authors read and approved the final version of the manuscript.

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Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due participant confidentiality but are available from the corresponding author on reasonable request.

Ethical statements

After obtaining approval for the protocol from the bioethics commission of the Faculty of Medical Sciences of the University of Cuenca and from the authorities of the José Carrasco Arteaga Hospital, we collected the information di-

rectly from medical records, without interaction with patients, for which informed consent was not required, respecting the confidentiality of the personal data of the participants by using codes or medical record numbers for each patient instead of names. These codes and numbers were administered and reviewed only by the author and thesis supervisor, and will be kept in absolute confidentiality for up to one year after publication. All the information collected was used solely for research purposes and published in the author's title work and derived scientific products.

Protection of persons

The authors declare that the procedures followed were in accordance with the ethical standards of the responsible human experimentation committee and in accordance with the World Medical Association and the Declaration of Helsinki.

Confidentiality of the data

The authors declare that they have followed the protocols of their work center on the publication of patient data.

Consent for publication

The authors have obtained the informed consent from the caretakers of the patients referred to in the article. This document is in the possession of the corresponding author. The parents have signed the authorization for publication of this article.

Competing interests

The authors have no competing interests to declare.

References

1. World health statistics. Geneva: WHO; 2007. Available from: http://www.who.Int/whosis/whostat2007.
2. Moreno-Pérez D, Andrés Martín A. Neumonía adquirida en la comunidad: tratamiento ambulatorio y prevención. Anales de Pediatría.2014;(83):2,3. DOI: 10.1016/j.anpedi.2014.10.028
3. Marrero M, López M, Sánchez J, Blanco A, Santamaría C, Hernández J. Neumonías Graves y Estado Nutricional en pacientes. Rev Cubana de Medicina Intensiva y Emergencias 2005;4(4) DE: bvs.sld.cu/revistas/mie/vol4_4_05/ mie04405.htm
4. Quinde Velastegui J, Trejo Angulo N. Neumonía grave en niños menores de 5 años. [Tesis Pregrado] Universidad de Guayaquil. Mayo 2019. **SU**: repositorio.ug/43464/
5. Rodríguez Y, Mengana E, Farinas A, García Y. Categorización Clínico epidemiológica de pacientes con neumonía grave. Hospital Infantil Norte de Santiago de Cuba. 2012 – 2013. Rev Cubana Pediatr. 2018;90(3):0-1. **SU**: revpediatria.cu/455/209
6. Cáceres Roque O, Hernándes García S, Cutiño Miraba L, Gonzalez Lobo E, Días Acosta J. Comportamiento de las neumonías complicadas en niños en Hospital pediátrico provincial pinareño. Revista de Ciencias Médicas de Pinar del Río 2018;(6):2-6. **SU**: scielo.cu/S1561
7. Andrés Martín A, Asensio de la Cruz O, Pérez Pérez G. Complicaciones de la neumonía adquirida en la comunidad: derrame pleural, neumonía necrotizante, absceso pulmonar y pioneumotórax Protoc diagn ter pediatr. 2017;1:127-146. **SU**:aeped.es/09
8. Inostroza E, Pinto R. Nuevos virus respiratorios en pediatría. Revista médica Clínica Condes [Internet]. 2017. Disponible en **DOI**: 10.1016/j.rmclc.2017.01.005
9. Rodríguez Cutting J, Vega Mendoza D, Pacheco Torres L, Piedra Bello M, García Sánchez J, Del Valle Rosríguez R. Característicccas clínicas e imagenológicas de niños con neumonía complicada causada por Streptococcus pneumoniae. Revista Cubana de pediatría. 2017; (89): 67,69. **SU**: scielo.cu/S0034
10. Álvarez Andrade M, Hernández Oliva M, Brito Tavares Y, Sánchez Pérez L, Cuevas Álvarez D. Riesgo de neumonía grave en niños menores de 5 años. Revista Habanera de Ciencias Médicas. 2018; (3): 410-418. **SU**: revhabanera.cu/2203
11. Vera Coronel M, Florentín G. Características clínicas y epidemiológicas de la neumonía complicada en escolares hospitalizados en el Hospital Central del Instituto de Previsión Social, 2016. Rev Cient Facultad de Ciencias Médicas Univ Nacional de Caaguazú 2019;1(2):12-21. **SU**: fcmunca.py/12
12. Carranza Berna G. Características clínicas, radiológicas y tratamiento antibiótico de niños menores de 5 años con neumonía adquirida en la comunidad hospitalizados en el servicio de pediatría del Hospital Regional Docente de Cajamarca de enero – diciembre del 2018". [Tesis] Universidad Nacional de Cajamarca 2019. SU: repositorio.unc.pe/2662
13. Sánchez Infante C, Ramos Carpente L, Reyes López M, Barreiro Paredes B, Cantillo Gámez H, Martínez Silva I. Evolución clínica, aislamiento microbiológico y costo antimicrobiano de la neumonía complicada adquirida en la comunidad. Revista cubana de Pediatría. 2017;(89): 15-19. **SU**: revpediatria.cu/294/97
14. Anzieta J, Jans J, Manoli P, Lagos .L, Cardemil C, Cerda O. Pleuroneumonías pediátricas en Hospital Clínico Regional Valdivia (HCRV): manejo médico-quirúrgico. Cuadernos de Cirugía, 2018;20(1):36-42. **DOI**: 10.4206/cuad.cir.2006.v20n1-06

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