

Original Paper

Bacterial Pneumonia in Children - Epidemiological Study on Nine Years

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REZUMAT

Pneumoniile bacteriene la copil - studiu epidemiologic pe 9 ani

Pneumonia se definește ca inflamație a parenchimului pulmonar, afectând spațiul alveolar. WHO a estimat o incidență mediană a pneumoniei pe glob de 0,28 episoade/copil/an. Aceasta conduce la o incidență anuală de 150,7 mil cazuri noi, dintre care 11 - 20 milioane (7 - 13%), sunt severe necesitând internare. În țările în curs de dezvoltare apar 95% dintre episoadele de pneumonie la copilul mic. Studiul a fost realizat pe baza unei anchete epidemiologice descriptive, retrospective în cadrul Spitalului Clinic de Urgență pentru Copii „Grigore Alexandrescu”, pe 9 ani (2004-2012). S-au analizat 6637 de cazuri, 0-18 ani de ambele sexe. În medie, internările din clinica de pediatrie au reprezentat 37,55% din totalul internărilor în spital, iar internările pentru boli respiratorii au reprezentat 22,19% din totalul internărilor în spital și respectiv 59,1% din totalul internărilor în clinica de pediatrie. Pneumoniile au reprezentat 2,4% din totalul internărilor pe spital, 6,41% din totalul internărilor din clinica de pediatrie și respectiv 10,85% din totalul internărilor pentru boli respiratorii. Insuficiența respiratorie acută a fost asociată în 371 cazuri, pleurezia - în 29 cazuri, iar 17 cazuri au fost asociate cu sepsis. Cazurile de afecțiuni respiratorii au crescut semnificativ, mai ales cele de pneumonie bacteriană. Etiologia pneumoniilor s-a diversificat ca spectru de germeni odată cu evoluția cronologică.

Cuvinte cheie: pneumonie bacteriană, studiu epidemiologic, copii

ABSTRACT

Pneumonia is defined as inflammation of the lung parenchyma, affecting the alveolar space. WHO estimated a median incidence of 0.28 episodes of pneumonia worldwide / child / year. This leads to an annual incidence of 150.7 million new cases, of which 11-20000000 (7-13%) are severe requiring hospitalization. In developing countries appear 95% of episodes of pneumonia in young children. The study was conducted based on a descriptive epidemiological surveys, retrospective in the Emergency Hospital for Children "Grigore Alexandrescu" 9 years (2004-2012). We analyzed 6637 cases of both sexes aged 0-18 years. The average pediatric clinic admissions represented 37.55% of all hospital admissions and admissions for respiratory

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diseases accounted for 22.19% of all hospital admissions and 59.1% respectively of the total admissions to the pediatric clinic. Pneumonia accounted for 2.4% of all admissions to hospital, 6.41% of all admissions in the pediatric clinic and 10.85% respectively of the total admissions for respiratory diseases. Acute respiratory failure has been associated in 371 cases, pleurisy - in 29 cases, and 17 cases were associated with sepsis. Cases of respiratory diseases increased significant endorsement, especially bacterial pneumonia. The etiology of pneumonia diversified spectrum of germs with the chronological evolution.

Key words: bacterial pneumonia, epidemiological study, children

INTRODUCTION

Pneumonia can be defined as an inflammation of the pulmonary parenchyma, mainly affecting the alveolar space. Inflammation can be caused by bacteria and viruses, as well as by inhalation of chemical agents or due to thoracic trauma (1,2,6).

Most authors classify bacterial pneumonias depending on the pathogenic agent, this classification including species of *Pneumococcus*, *Hamophilus Influenzae*, *Klebsiella*, *Staphylococcus*, *Legionella* and other gram-negative microorganisms. Some germs, especially *Staphylococcus* may be disseminated in a haematogenous manner.

The Paediatric Epidemiology Group of WHO (World Health Organization) estimated a median incidence of worldwide pneumonia of 0.28 episodes / child / year (3,13,14). This leads to an annual incidence of 150.7 million new cases, of which 11-20 million (7-13%) are severe and require hospitalization. In developing countries appear 95% of episodes of pneumonia in young children(5,8).

In North America, the annual incidence of pneumonia ranges from 6 to 12 cases / 1,000 children over age of 9 and up to 30-45 cases / 1,000 children under age of 5 (8,9). In Europe occur about 2.5 million cases / year (10).

A study of 750 children hospitalized in 13 hospitals in the UK published by Clark JE et al, "Epidemiology of Community-Acquired Pneumonia in children seen in hospital", *Epidemiol Infect*, 2007, showed an incidence of 14.4 cases / 10000copii / year, and the rate of hospitalizations was 12.2%.

According to the National Protocol for Diagnosis and Treatment, bacterial pneumonia is more common in children from the age of 3, basically after their entry into the community.

Working material and methods

The study was conducted based on a descriptive

and retrospective epidemiological survey within the Emergency Clinical Hospital for Children (SCUC) "Grigore Alexandrescu" over a period of 9 years (2004-2012).

It was conducted a descriptive transversal observational study based on a retrospective analysis of patients diagnosed with bacterial pneumonias, hospitalized in the clinic during this period. The study included 6637 children (boys and girls) aged between 0 and 18 years of both genders, the lot being registered within the Sections of Paediatrics, Toxicology and Surgery - the Clinical Hospital "Grigore Alexandrescu" from Bucharest, during the period between January, 2004 and December, 2012.

For patients with bacterial pneumonia, the diagnostic criteria that allowed their inclusion in the study group were those recommended by the European Respiratory Society:

- In new-borns - irritability and refusal of food, fever along with an altered general condition, functional respiratory syndrome (pre-inspiratory nasal wing beats, intercostal and sub-costal flue, thoracic and abdominal balance), tachypnea (≥ 60 rpm), associated pallor/not with extremity cyanosis, crepitant and sub-crepitant rales, decreased peripheral SatO₂ in pulse oximetry.
- In infants over 1 month of age was added cough - dry, productive or emetic.
- Fever may be absent in older children, but were added twinges and chest pain, as well as tiring emetic cough.
- Laboratory - neutrophilic leucocytosis +/- with left shift of leukocyte formula, inflammatory syndrome, sometimes positive blood cultures (10% of cases), positive gastric or tracheobronchial aspirate, sputum test - positive.
- Significant changes in pulmonary radiography for pneumonia, from the increase of the interstice up to clear condensation areas, of

alveolar damage.

- Pulmonary CT - reserved for less clear cases, offers significant clarifications.

There were followed using observation sheets, the clinical, paraclinical, microbiological, etiologic and therapeutic aspects specific to bronchopulmonary alveolar illnesses, as well as the factors that trigger or favour such illnesses and their complications.

Data were statistically processed and interpreted using Microsoft Office Excel 2010.

Outcome

Upon analysing the evolution of hospital admissions in the paediatric clinic and those for respiratory diseases during the studied period, it was noted a relatively constant number of annually hospitalized cases both in the hospital and the paediatric clinic, in the period between 2004 and 2010 (a total number of patients admitted in hospital between 31000 and 32500), followed by a decrease in the number of admissions in 2012 up to 10%.

Averaged over nine years, the clinical paediatric admissions represented 37.55% of the total hospital admissions and the admissions for respiratory illnesses represented 22.19% of all hospital admissions, respectively 59.1% of the total admissions to the paediatrics clinic. Pneumonia represented on average 2.4% of all admissions to hospital, 6.41% of

all admissions in the paediatrics clinic and 10.85% respectively of the total admissions for respiratory illnesses.

In 2004, of a total of 9952 admissions to the Paediatric Clinic, we found 6053 cases of respiratory illnesses, of which 162 were cases of bacterial pneumonia. In the following years, the number of cases of bacterial pneumonia increased significantly, correlated with an increased number of hospitalizations in the paediatric clinic, reaching a peak in 2009, when 12,961 cases were hospitalized in the paediatric clinic, of which 7512 were respiratory illnesses, and of these 1179 were bacterial pneumonias. Later on, there was a slight decrease in the number of admissions; in 2012 were 10,513 hospitalizations in the paediatric clinic, with 6623 cases of respiratory illnesses, of which 1083 were bacterial pneumonias (fig. 1).

If in 2004 the hospitalizations for respiratory illnesses accounted for 68.76% of all admissions to the Paediatric Clinic, in the following years their incidence has dropped to a minimum value of 54% in 2010.

In particular, the cases of respiratory illnesses treated in the clinic had an annual growth rate proportional to the total admissions of all studied years. (fig. 2)

Compared to the total number of cases admitted

Figure 1. Annual admissions to the hospital and paediatric ward, hospitalizations for respiratory illnesses

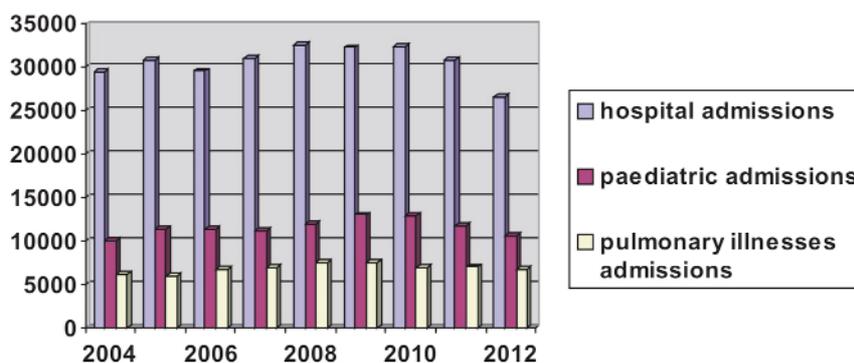
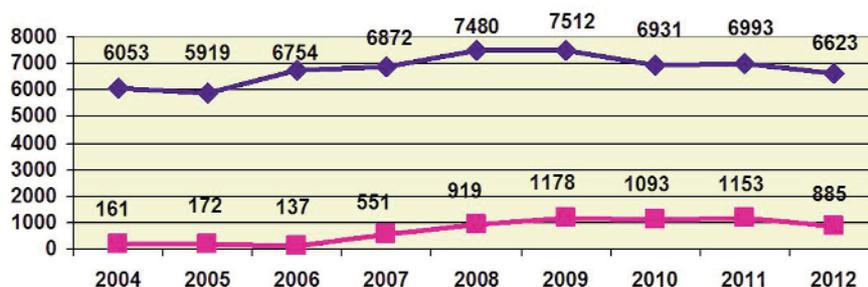


Figure 2. Dynamics of admissions for respiratory illnesses and pneumonias



for respiratory illnesses, bacterial illnesses have reached a significant figure in each of the studied years.

In terms of aetiology, we have highlighted, since 2004, a significantly higher number of cases in which no definite aetiology could be established through positive cultures.

As a remark, we mention the fact that although the number of bacterial pneumonias has significantly increased in recent years, the identification of aetiology is proportionally smaller due to previous empirical antibiotic therapy, and the germs became more difficult to cultivate, requiring special environments. (fig. 3). Also, it must be taken into account the fact that the collection of samples for cultures is performed using a relatively invasive technique, namely the tracheobronchial aspirate.

Among the cases whose aetiology could be identified, the most common are the cases of Pneumococcal pneumonia, throughout all studied years. A relatively large number of cases of Chlamydia pneumonia was identified between 2004 and 2005, and in 2008 was recorded a higher number of cases of pneumonia with Haemophilus Influenzae (fig. 4).

By adding the bacterial pneumonia cases we have

identified 6637 patients who, during the study period, had admissions in the SCUC, of which the aetiological agent was isolated in 372 cases, accounting for 5.60% of the total cases.

Of the 6637 hospitalized cases of pneumonia, 371 cases were associated with acute respiratory failure, 29 cases with pleurisy of the large cavity, 17 cases have been associated with sepsis, and 2 with pulmonary abscess. (fig. 5)

The survey distribution by age and gender of bacterial pneumonias showed two prevalence peaks: one in infants under 1 year and 1 year old young children, and the second one in the age group of 5-9 years old, both with predominance of males. (table 1, fig. 6)

Distribution analysis of pneumonias by calendar years and gender showed a clear prevalence of males, as for the annual distribution, it showed a constant, gradual and significant growth of number of cases from 2004 to 2012, with peak prevalence in 2011, mainly affecting males. (fig. 7)

DISCUSSIONS

Bacterial pneumonias represent a common illness in the paediatric age, with a general favourable

Figure 3. Identifying the aetiology of bacterial pneumonias

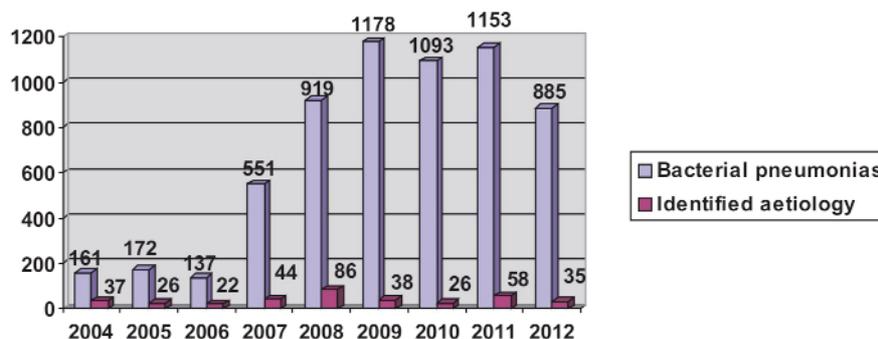
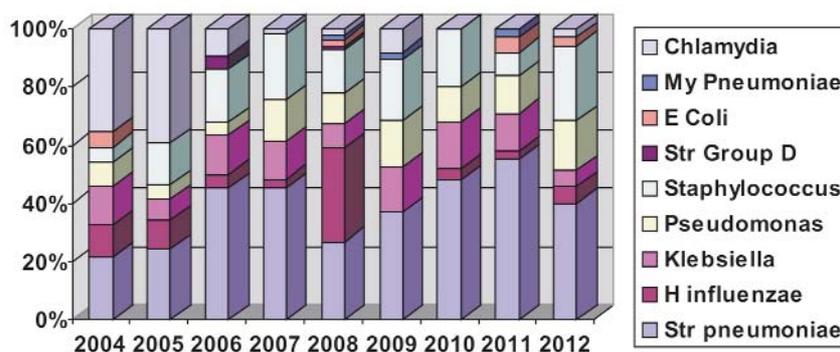


Figure 4. Aetiological spectrum of pneumonias



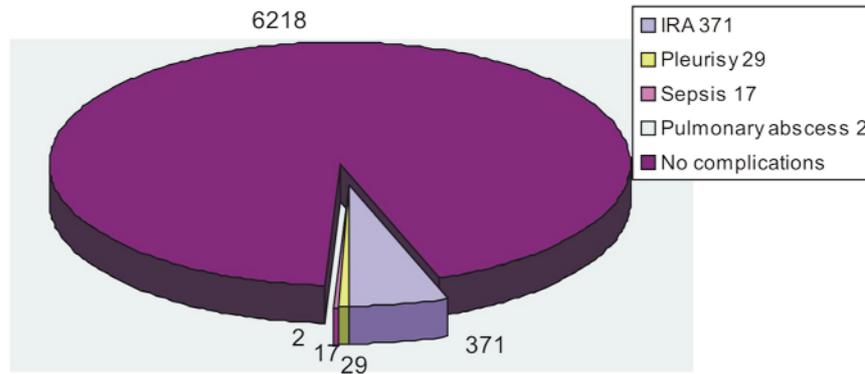


Figure 5. Complications of pneumonias

Table 1. Age-gender distribution for cases of pneumonia

Age group / gender PNEUMONIAS		gender		Total
		F	M	
<12 months	No. of cases	491	963	1454
	%	33.8%	66.2%	
1 year	No. of cases	560	979	1539
	%	36.4%	63.6%	
2 years	No. of cases	429	604	1033
	%	41.5%	58.5%	
3 years	No. of cases	366	396	762
	%	48.0%	52.0%	
4 years	No. of cases	257	270	527
	%	48.8%	51.2%	
5-9 years	No. of cases	391	486	877
	%	44.6%	55.4%	
10-14 years	No. of cases	144	168	312
	%		46.2%	53.8%
15-19 years	No. of cases	74	59	133
	%	55.6%	44.4%	
Total	No. of cases	2712	3925	6637
	%	40.9%	59.1%	

trend with antibiotic and supportive therapy, but with the possibility of complications with other bronchopulmonary suppurations.

Respiratory illnesses represent at least a half of the number of emergency hospitalizations in a paediatric hospital with a paediatric emergency profile.

Bacterial pneumonias represent on average 10.85% of the total admissions for respiratory illnesses in the Paediatric Clinic, percentage increased considerably compared to the 3.64% reported by WHO; interpret this result by the fact that the reporting was done on a selected population group of cases consulted / admitted in "Grigore Alexandrescu" Hospital and were evaluated only severe

cases of bacterial pneumonia that required hospitalization (12,13,14). The number of cases of bacterial pneumonias has significantly increased in recent years, while the rate of determining the aetiology has decreased along with the chronological evolution. This fact revealed by the statistical analysis, can be explained by the difficulty of harvesting laboratory samples required to indicate the aetiology, primarily due to the invasiveness of the harvesting techniques (the tracheobronchial aspiration requires general anaesthesia to be harvested), and by increasing rigor, as well as a more precise approach to diagnostic criteria. The aetiological agent was isolated in 5.60% of the hospitalized cases of pneumonia.

Figure 6. Age-gender distribution for cases of pneumonia

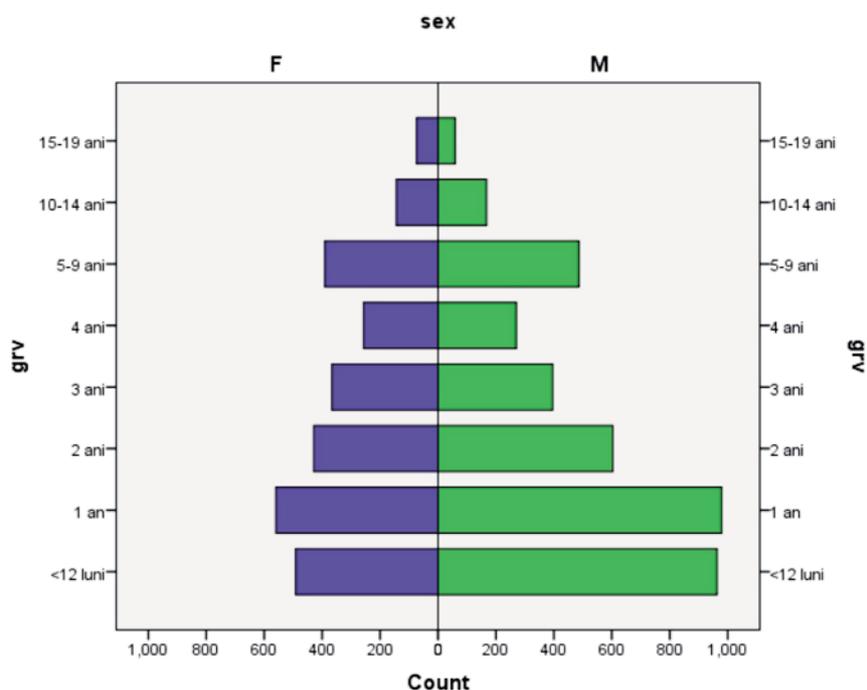
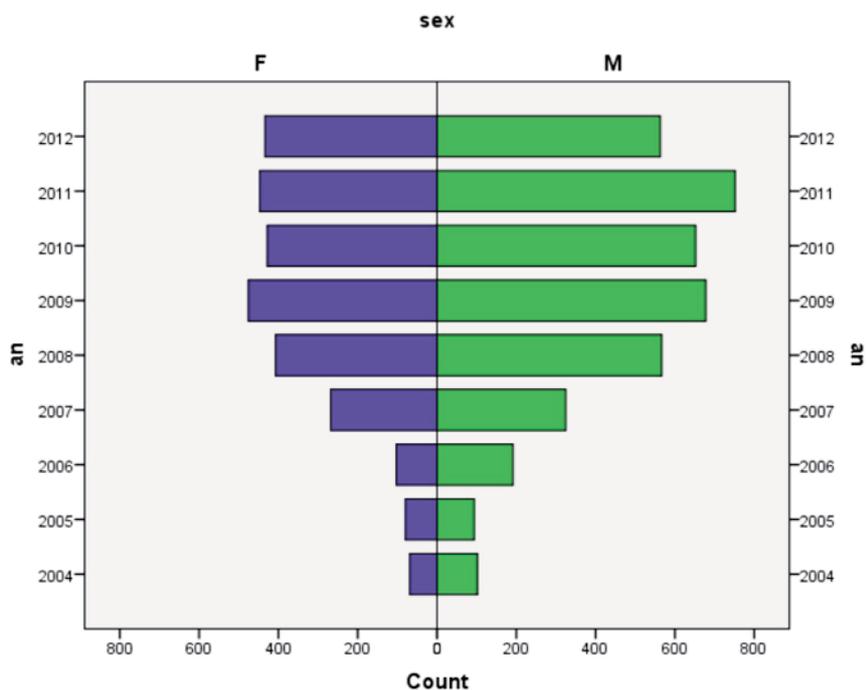


Figure 7. Year-gender distribution for admission of cases of pneumonia



In an article published in the WHO Bulletin in May 2008, Igor Rudan et al state that there is a very limited number of studies that have considered the identification etiology Community pentrumoniilor the child (15).

In a study of 15 months on 395 patients, published by Mauricio Ruiz et al in ATC Journals in

1999 (16), bacterial etiologic agent was identified in 46% of cases. Samples that has been processed were: sputum examination, blood cultures, serology, samples of pleural fluid, transthoracic puncture, tracheobronchial aspirates and bronchial brushings. It also noted that the patients in the study group were both children and adults.

Another study conducted in Finland, in a group of 201 children, published in the *Pediatric Infectious Diseases Journal* in 1998 showed that lung radiographs and serological tests could identify the etiology of viral / bacterial in 66% of cases studied.

A study at the University of Texas in the period 1999 - 2000 on a sample of 154 children hospitalized for pneumonia in immunocompetent, established etiology in 79% of cases, mostly infections with *Streptococcus pneumoniae* (*Epidemiology and Clinical Characteristics of Community-Acquired Pneumonia in hospitalized children*. Michelow IC et al, *Pediatrics*, April 2004).

Regarding gender distribution, it was shown a higher prevalence of this illness in males. I interpret these data by the fact that the population included in the study was a selected population from the hospitalized cases, thus, cases with an unfavourable evolution at home.

CONCLUSIONS

1. The number of cases with respiratory illnesses has significantly increased, especially the bacterial pneumonia cases.
2. The aetiology of bacterial pneumonias has diversified as spectrum of germs along with the chronological evolution.
3. Although the patients have received the best care, the number of cases complicated by pleurisy in the large cavity was similarly high in all studied years.
4. For most cases of bacterial pneumonia it could not be established a definite aetiology.
5. Analysis of all cases of pneumonia showed a prevalence of cases in males in all studied age groups.

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