

## Prevalence of Severe Community-Acquired Pneumonia in Pediatrics

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### Abstract

**Background:** Community-acquired pneumonia is the most severe form of acute respiratory infections.

**Aim of Study:** This study aimed to assess the prevalence of severe community-acquired pneumonia in children.

**Patients and Methods:** A cross sectional study was conducted on 40 children with community acquired pneumonia. Demographic and clinical data were collected. Routine laboratory tests were drawn and sent for analysis. Imaging techniques as X-ray and, computed topography was used to assess the diagnosis of pneumonia.

**Results:** The mean age of the studied patients was  $4.1 \pm 1.4$ . Males represented about (60%) of the study population. Severe pneumonia was prevalent among 30% of the patients. Blood levels of routine tests were elevated among 30% of the patients.

**Conclusion:** Severe pneumonia is not uncommon among pediatric patients with community-acquired pneumonia.

**Key Words:** *Community-acquired pneumonia – Children.*

### Introduction

**COMMUNITY-ACQUIRED** pneumonia (CAP) in childhood is defined as an acute infection of the pulmonary parenchyma in a child caused by a pathogen acquired as distinguished from hospital-acquired (nosocomial) pneumonia. CAP is a common and potentially serious illness with considerable morbidity [1].

Pneumonia has been the leading cause of death in children younger than 5 years for decades. Although there have been substantial decreases in overall child mortality and in pneumonia-specific mortality, pneumonia remains the major single cause of death in children outside the neonatal period, causing approximately 900,000 of the estimated 6.3 million child deaths in 2013 [2].

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Substantial advances have occurred in the understanding of risk factors and etiology of pneumonia, in development of standardized case definitions, and in prevention with the production of improved vaccines and in treatment. Such advances have led to changes in the epidemiology, etiology and mortality from childhood pneumonia. However, in many areas access to these interventions remains sub-optimal, with large inequities between and within countries and regions [3].

Early recognition of severe forms of CAP is vital for early hospitalization and appropriate treatment of the patients. The clinical status, oxygen saturation, and comorbidity mainly determine the need for hospitalization, while certain laboratory parameters can also facilitate the assessment of the severity of the disease [4].

So, in this study, we aimed to assess the prevalence of severe pneumonia in pediatric patients with community acquired pneumonia.

### Patients and Methods

This was a cross sectional study conducted on 40 children with a proven diagnosis of CAP at the children's teaching hospital, Cairo during the period between October 2020 to December 2020. The children with CAP were categorized according to degree of severity based on clinical and radiological findings. This study was approved by an Ethical committee and a written consent was obtained from the parents and children aged more than 8 years prior to inclusion in the study.

Our inclusion criteria for CAP group were children admitted to the outpatient clinics and met the diagnostic criteria of CAP which are: The clinical findings of fever, cough, respiratory distress (e.g., tachypnea, intercostal/subcostal/suprasternal retractions, nasal flaring, grunting), and/or radio-

logic evidence of an acute pulmonary infiltrate/consolidation. We excluded every child who had any other respiratory problems.

Regarding the investigations, blood samples were withdrawn from children under complete aseptic condition. Routine lab investigations such as complete blood count (CBC), liver function, kidney function, and random blood glucose.

#### Statistical analysis:

The data were coded, collected on an Excel sheet, and processed using SPSS 20 (Armonk, NY/USA). Descriptive statistics were represented by percent (%), and number (N). Mean, standard deviation (SD), range, minimum and maximum, and median were all used to describe quantitative data. Chi-square test ( $\chi^2$ ): was used to study the relation between two categorical variables. The *p*-value <0.05 was considered the cut-off value for significance.

### Results

40 children were included in our study. The median age of pneumonic children was 4 years. Males represented 60% of the study population (Table 1).

Table (1): Socio-demographic data among the studied patients.

Socio-demographic data	
Age (years):	
Mean $\pm$ SD	4.1 $\pm$ 1.4
Range	(0.6-5.5)
Gender:	
Male	24 (60.0%)
Female	16 (40.0%)
Residency:	
Urban	23 (57.5%)
Rural	17 (42.5%)
Consanguinity:	
Positive	16 (40.0%)
Negative	24 (60.0%)
Vaccination:	
Positive	25 (62.5%)
Negative	15 (37.5%)

This table shows that; the mean age of all patients was (4.1  $\pm$  1.4) years. Regarding gender of the patients, the majority (60.0%) of patients were males; while (40.0%) were females. Regarding residency, (42.5%) of patients live in rural areas, (57.5%) live in urban areas, with (40.0%) had positive consanguinity.

Table (2): Presenting symptoms among the studied pneumonic children.

Presenting symptoms	
<i>Duration of illness (days):</i>	
Mean $\pm$ SD	8.22 $\pm$ 3.2
Range	(1-15)
<i>Dyspnea:</i>	
Positive	30 (75.0%)
<i>Exercise intolerance:</i>	
Positive	28 (70.0%)
<i>Cough:</i>	
Dry	18 (45.0%)
Productive	22 (55.0%)
<i>Abdominal pain:</i>	
Positive	20 (50.0%)
Associated nutritional illness	18 (45.0%)

Regarding presenting symptoms; the average duration of illness was (8.22  $\pm$  3.2) days, with (45.0%) had dry cough, (55.0%) had productive cough, (75.0%) had dyspnea, (20.0%) had abdominal pain, and (70.0%) had exercise intolerance, 18 (45.0%) had associated nutritional illness.

Table (3): Presenting signs among the studied pneumonic children.

Clinical examination	
<i>Degree of fever (°):</i>	
Mean $\pm$ SD	38.8 $\pm$ 1
Range	(37.5-40)
<i>O<sub>2</sub> Saturation (%):</i>	
Mean $\pm$ SD	93.6 $\pm$ 5.2
Range	(88-98)
<i>Respiratory rate (breath/min):</i>	
Mean $\pm$ SD	35.28 $\pm$ 8.5
Range	(20-44)
Diminished air entry	25 (62.5%)
Fine crepitations	32 (80.0%)
Bronchophony	20 (50.0%)
Retractions	30 (75.0%)
Severe pneumonia	30 (75.0%)

Regarding clinical examination data; the average degree of fever was (38.8  $\pm$  1), the average O<sub>2</sub> saturation was (93.6  $\pm$  5.2) %, the average RR was (35.28  $\pm$  8.5) breath/min, with (75.0%) of patients had retractions, and (30.0%) had severe pneumonia.

Table (4): Laboratory data among the studied pneumonic children.

Laboratory data	Mean	SD	Range (Minimum)	Range (Maximum)
<i>CBC:</i>				
Hemoglobin	9.25	1.67	9.2	13.3
Platelets	342.01	148.64	16	793
Total leucocytic count (10 <sup>9</sup> / L)	18.83	20.15	3.5	40.2
Neutrophils (%)	50.177	14.5563	23	65
Lymphocyte (%)	36.755	15.6216	8	63
Urea	25.86	17.50	2.7	107
Creatinine	0.55	0.25	0.2	1.2
Alanine transaminase	45.83	110.97	8	170
Aspartate transaminase	36.18	67.11	8	140
Calcium	8.99	0.44	7.3	9.7
Phosphorus	4.02	0.60	3.2	6
Sodium	134.39	5.29	123	154
Potassium	4.07	0.65	3	6

This table shows that; the mean value of hemoglobin is (9.25±1.67), the mean total leucocytic count is (18.83±20.15), the mean neutrophil count is (50.177±14.5), while, the mean Alanine transaminase is 45.83±110.97.

Table (5): Radiological data among the studied pneumonic children.

Radiological data	
<i>Chest X-ray:</i>	
Opacities	32 (80.0%)
Pleural effusion	10 (25.0%)
Lung collapse	5 (12.5%)
<i>Chest computed tomography:</i>	
Consolidation	33 (82.5%)
<i>Pleural effusion:</i>	
Atelectasis	12 (30.0%)
Lung abscess	7 (17.5%)
	3 (7.5%)

Regarding radiological findings; (80.0%) of patients had opacities, (82.5%) had bilateral consolidation, 12 (30.0%) had pleural effusion, 5 (12.5%) had lung collapse, and 3 (7.5%) had lung abscess.

### Discussion

The present study was conducted on 40 children with CAP with the median age of (4.1 ± 1.4).

In the current study, we categorized the degree of severity of pneumonic children according to their clinical, laboratory and radiological data; children with severe pneumonia was reported among 30 (75.0%) of the studied patients. The complications presented in the current study were

pleural effusion (30.0%), followed by atelectasis (17.5%).

This result come in accordance with a previous study conducted Qin and shen [5] who reported that the complications of bacterial pneumonia included pleural effusion, empyema, pneumatoceles, necrotizing pneumonia, and lung abscesses.

Compared to our results, a recent study conducted by Alcoba et al., [6] including 88 children with CAP which reported that only (12.5%) of the studied patients presented with complicated CAP as follows: Empyema (10.2%), and bacteremia (4.5%), and 2 children had both complications.

The higher prevalence of severe pneumonia among the studied patients compared to other studies could be attributed to delayed diagnosis and lack of early management which led to this higher percentage of complications.

Our results found that the median age of the studied patients was 4 years, which goes in line with a study by Musolino et al., [7] who reported that children with complicated CAP pneumonia had a median age of 57 months (IQR: 16-162.5).

On the other hand, a study by Du et al., [8] reported that severe complicated were much among lower age group (8 months).

In the current study, we investigated symptoms and signs among the patients presented with CAP. We reported a high rate of dyspnea (75%), exercise intolerance (70%), and abdominal pain (50.0%). We also reported a long duration of illness (8.22 ±3.2) especially in severe cases.

On the contrary, Musolino et al., [7] reported non-significant difference between severe and non-severe cases of CAP in term of duration of illness before emergency department admission.

Moreover, majority of children with CAP presented with consolidations (82.5%) and radiological opacities (80.0%).

This finding comes in accordance with a study by Buonsenso et al., [9] who found that there was a significantly higher rate of consolidation (52.2%) in children with severe pneumonia having a surgical procedure when compared to children with less severe pneumonia (10.2%).

Regarding O<sub>2</sub> saturation, the studied children with CAP showed a mean of (93.6±5.2). In addition, the mean respiratory rate was (35.28 ±8.5).

These results come in accordance with a study by Pabary et al., [10] who reported that respiratory rate was reported to be <50 breath/min in children with severe CAP.

Moreover, Musolino et al., [7] reported a lower oxygen saturation in children with severe pneumonia with a mean of 96.5%.

In the current study, we reported low levels of hemoglobin in children with CAP (9.25g/dL). Regarding total leukocytic count, the mean level was (18.83±20.15), and the mean neutrophil count was (50.177±14.5).

On the same hand, Mohamed et al., [11] reported lower levels of Hb in pneumonic children when compared to controls, and much lower Hb levels in among severe ones, they also reported a significantly increased total leukocytic count.

Our results are in agreement with another study conducted by Sheb et al., (2020) [12] who found that Hb count was much lower in children with severe pneumonia (median=9, IQR: 8.5-9.5) compared to less severe children (median=10, IQR: 9-10.5). Also, they reported higher total leukocytic count in severe cases with a median of 14 (IQR: 13-15) compared to non-severe cases with a median of 13 (IQR: 11-13).

On the contrary, Masarweh et al., (2021) [13] reported that the total leukocytic count did not differ in both severe and non-severe pneumonia groups.

#### Conclusion:

In conclusion, our study demonstrated that severe pneumonia is prevalent among the studied patients and it was associated with worse clinical features, radiological findings and laboratory results. Therefore early diagnosis and proper management of patients with CAP is recommended to decrease the risk of complications.

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## معدل انتشار الالتهاب الرئوي الحاد المكتسب من المجتمع في طب الأطفال

المقدمة : كان ولا يزال الالتهاب الرئوي هو المسبب الأول والرئيسي لوفاة الأطفال تحت سن الخامسة لعقود عديدة، وبالرغم من الجهود المكثفة لتقليل نسب هذه الوفاة في الأطفال إلا أنه لا يزال الالتهاب الرئوي هو المتسبب الرئيسي لوفاة الأطفال الأقل عمراً من خمس سنوات بما يقارب ٩٠٠ ألف من أصل ٦.٣ مليون طفل توفوا خلال عام ٢٠١٣.

الالتهاب الرئوي المكتسب من المجتمع يعرف على أنه التهاب حاد يصيب الهيكل الداخلي لرئة الطفل بسبب ميكروب مكتسب من المجتمع وهذا يختلف عن الإصابة بهذا الالتهاب داخل المستشفيات. كما يعد الالتهاب من هذا النوع هو مرض خطير بل ولديه القدرة على أحداث مضاعفات عديدة.

الهدف من الدراسة : هدفت هذه الدراسة إلى تقييم انتشار الالتهاب الرئوي الحاد المكتسب من المجتمع عند الأطفال.

المنهج وطرق البحث : تم تنفيذ هذه الدراسة المقطعية في مستشفى الأطفال التعليمي بالقاهرة في الفترة من بداية شهر أكتوبر إلى ديسمبر لسنة ٢٠٢٠.

تمت هذه الدراسة على ٤٠ طفل الذين يعانون من الالتهاب الرئوي الحاد وتم تقييمهم على حسب الأعراض الإكلينيكية والفحوصات التحقيقات الإشعاعية.

هؤلاء الأطفال قيد الدراسة قد تم لهم الآتي :

التاريخ المرضي الكامل والذي يشتمل على الاسم والعمر والجنس والتاريخ المرضي. أيضاً تم تقييم (١) أعراض الالتهاب الرئوي والتي تتمثل في (الكحة وألم البطن ونقصان الوزن وعدم القدرة على ممارسة الرياضة وتقييم مدة المرض وتناول المضادات الحيوية قبل دخول المستشفى). كما تم أيضاً فحص الجهاز التنفسي فحصاً كاملاً. (٢) الاختبارات المعملية والتي اشتملت على صورة الدم الكاملة، كما تم قياس مستويات أملاح الدم في هؤلاء الأطفال. أيضاً كما تم عمل فحوصات تصويرية على الصدر الأشعة السينية لاستبعاد وجود مضاعفات، كما تم عمل أشعة مقطعية لاستبعاد وجود مضاعفات. أيضاً تم عمل فحوصات معملية خاصة للمرض.

معايير الاشتمال : الأطفال الذين لديهم أمراض رئوية مزمنة مثل مرض الدرن.

النتائج : كان متوسط عمر المرضى الخاضعين للدراسة  $١.٤ \pm ١.١$  شكل الذكور حوالي (٦٠٪) من مجتمع الدراسة. انتشر الالتهاب الرئوي الحاد بين ٣٠٪ من المرضى. تم رفع مستويات الدم في الاختبارات الروتينية بين ٣٠٪ من المرضى

أيضاً أظهرت النتائج أن متوسط مدة المرض  $(٣.٢ \pm ٨.٢٢)$  يوم، مع لديهم سعال جاف، (٥٥.٠٪) لديهم سعال منتج، (٧٥.٠٪) يعانون من ضيق التنفس، (٢٠.٠٪) لديهم ألم في البطن، (٧٠.٠٪) كان لديهم عدم تحمل لممارسة الرياضة، ١٨ (٤٥.٠٪) يعانون من أمراض التغذية.

الخاتمة : في الختام، أظهرت دراستنا أن الالتهاب الرئوي الحاد منتشر بين المرضى الخاضعين للدراسة وكان مرتبطاً بسمات سريرية أسوأ ونتائج إشعاعية ونتائج معملية. لذلك يوصى بالتشخيص المبكر والإدارة السليمة للمرضى الذين يعانون من CAP لتقليل مخاطر حدوث مضاعفات.