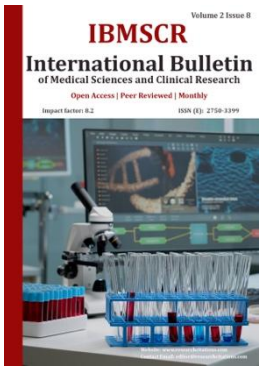


# CLINICAL PRESENTATION AND RESPIRATORY FUNCTIONAL CHANGES IN ACUTE PNEUMONIA IN PEDIATRIC PATIENTS OF EARLY AGE

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**Abstract**

**Background.** Acute pneumonia remains one of the leading infectious diseases in early childhood and is associated with a high risk of severe clinical manifestations due to the anatomical and physiological immaturity of the respiratory system and immune response. The presence of comorbid conditions such as anemia, rickets, perinatal central nervous system injury, hypotrophy, and exudative–catarrhal diathesis can aggravate the course of the disease and contribute to the development of complications.

**The aim of the study.** To assess the clinical characteristics and functional status of young children with acute pneumonia depending on age, disease severity, and associated comorbid conditions.

**Materials and methods.** The study included 100 children aged 6 months to 3 years with acute pneumonia who received inpatient treatment at the Department of Pediatric Pulmonology of Clinic I and the Central Research Laboratory of the Tashkent Medical Academy between 2000 and 2004. A control group consisted of 30 apparently healthy children of comparable age and sex. Patients were divided into three age groups: 6 months–1 year (n=31), 1–2 years (n=43), and 2–3 years (n=26). Diagnosis was established based on clinical examination, laboratory tests, and chest radiography. Standard diagnostic procedures included complete blood count, bacteriological examination of nasopharyngeal and oropharyngeal swabs, and radiological assessment.

**Results.** At hospital admission, 63% of children presented in severe condition and 23% in extremely severe condition, most frequently among infants in the first year of life. Concomitant diseases were highly prevalent, particularly anemia (95%) and rickets (57%). Perinatal encephalopathy, hypotrophy, and exudative–catarrhal diathesis were also observed, predominantly in the youngest age group. Focal pneumonia was the most common clinical form (76%), while segmental pneumonia occurred more frequently in older children. Community-acquired infection accounted for 88% of cases, whereas nosocomial pneumonia represented 12%. The etiological pathogen was identified in 50% of examined patients, with the most common microorganisms being *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Escherichia coli*, and *Proteus* spp. The disease course was often accompanied by multiple clinical syndromes, including cardiorespiratory syndrome (95%), toxic syndrome (40%), neurotoxicosis (45%), bronchial obstruction (28%), and varying degrees of respiratory failure.

**Conclusion.** Acute pneumonia in young children is characterized by severe clinical manifestations, particularly in infants under one year of age, who more frequently develop extremely severe forms of the disease, respiratory failure, and neurotoxic complications. The high prevalence of comorbid conditions significantly influences the course and severity of

pneumonia. These findings emphasize the importance of early diagnosis and comprehensive management strategies that consider the severity of intoxication, associated syndromes, and underlying comorbidities.

**Keywords:** acute pneumonia, young children, respiratory failure, cardiorespiratory syndrome, neurotoxicosis, comorbid conditions, anemia, rickets, pediatric pulmonology.

**Аннотация**

**Актуальность.** Острая пневмония остаётся одним из ведущих инфекционных заболеваний у детей раннего возраста и сопровождается высоким риском тяжёлых клинических проявлений вследствие анатомо-физиологической незрелости дыхательной системы и иммунного ответа. Наличие сопутствующих состояний, таких как анемия, рахит, перинатальное поражение центральной нервной системы, гипотрофия и экссудативно-катаральный диатез, может утяжелять течение заболевания и способствовать развитию осложнений.

**Цель исследования.** Оценить клинические особенности и функциональное состояние детей раннего возраста с острой пневмонией в зависимости от возраста, тяжести заболевания и наличия сопутствующей патологии.

**Материалы и методы.** В исследование включены 100 детей в возрасте от 6 месяцев до 3 лет с острой пневмонией, находившихся на стационарном лечении в отделении детской пульмонологии Клиники I и Центральной научно-исследовательской лаборатории Ташкентской медицинской академии в 2000–2004 гг. Контрольную группу составили 30 практически здоровых детей сопоставимого возраста и пола. Пациенты были распределены на три возрастные группы: 6 месяцев – 1 год (n=31), 1–2 года (n=43) и 2–3 года (n=26). Диагноз устанавливался на основании клинического обследования, лабораторных исследований и рентгенографии органов грудной клетки. Стандартные диагностические процедуры включали общий анализ крови, бактериологическое исследование мазков из носоглотки и ротоглотки, а также рентгенологическое обследование.

**Результаты.** При поступлении в стационар 63% детей находились в тяжёлом состоянии и 23% — в крайне тяжёлом, преимущественно среди детей первого года жизни. Сопутствующие заболевания выявлены с высокой частотой, особенно анемия (95%) и рахит (57%). Перинатальная энцефалопатия, гипотрофия и экссудативно-катаральный диатез также чаще наблюдались в младшей возрастной группе. Очаговая пневмония являлась наиболее распространённой клинической формой (76%), тогда как сегментарная пневмония чаще встречалась у детей старшего возраста. Внебольничная инфекция составила 88% случаев, нозокомиальная пневмония — 12%. Этиологический возбудитель был идентифицирован у 50% обследованных пациентов; наиболее часто выявлялись *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Escherichia coli* и *Proteus spp.* Течение заболевания нередко сопровождалось развитием нескольких клинических синдромов, включая кардиореспираторный синдром (95%), токсический синдром (40%), нейротоксикоз (45%), бронхообструктивный синдром (28%) и различные степени дыхательной недостаточности.

**Заключение.** Острая пневмония у детей раннего возраста характеризуется тяжёлыми клиническими проявлениями, особенно у детей до одного года жизни, у которых чаще развиваются крайне тяжёлые формы заболевания, дыхательная

недостаточность и нейротоксические осложнения. Высокая распространённость сопутствующей патологии существенно влияет на течение и тяжесть пневмонии. Полученные данные подчёркивают необходимость ранней диагностики и комплексного подхода к лечению с учётом степени интоксикации, сопутствующих синдромов и фоновых заболеваний.

**Ключевые слова:** острая пневмония, дети раннего возраста, дыхательная недостаточность, кардиореспираторный синдром, нейротоксикоз, сопутствующая патология, анемия, рахит, детская пульмонология.

**Аннотация**

**Долзарблиги.** Ўткир пневмония эрта ёшдаги болаларда энг кўп учрайдиган инфекцион касалликлардан бири бўлиб, нафас олиш тизими ва иммун жавобнинг анатомик-физиологик жиҳатдан етарлича шаклланмаганлиги туфайли оғир клиник намоёнлар билан кечиши мумкин. Камқонлик, рахит, марказий нерв тизимининг перинатал шикастланиши, гипотрофия ва экссудатив-катарал диатез каби ҳамроҳ ҳолатлар касаллик кечишини оғирлаштириб, асоратлар ривожланишига олиб келиши мумкин.

**Тадқиқот мақсади.** Эрта ёшдаги болаларда ўткир пневмониянинг клиник хусусиятлари ва функционал ҳолатини ёш, касаллик оғирлиги ва ҳамроҳ патологияга боғлиқ ҳолда баҳолаш.

**Материаллар ва усуллар.** Тадқиқотга 2000–2004 йилларда Тошкент тиббиёт академиясининг I-клиникаси Болалар пульмонологияси бўлими ва Марказий илмий-тадқиқот лабораториясида стационар даволанган 6 ойдан 3 ёшгача бўлган 100 нафар ўткир пневмонияли бола киритилди. Назорат гуруҳини ёши ва жинси мос келувчи 30 нафар соғлом бола ташкил этди. Беморлар уч ёш гуруҳига ажратилди: 6 ой – 1 ёш (n=31), 1–2 ёш (n=43), 2–3 ёш (n=26). Ташхис клиник текширув, лаборатор таҳлиллар ва кўкрак қафаси рентгенографияси асосида қўйилди. Стандарт диагностика умумий қон таҳлили, носоғлом ва оғиз бўшлиғидан олинган суртмаларнинг бактериологик текшируви ҳамда рентгенологик баҳолашни ўз ичига олди.

**Натижалар.** Стационарга қабул қилинганда болаларнинг 63%и оғир, 23%и ўта оғир ҳолатда бўлган, айниқса биринчи ёш гуруҳида. Ҳамроҳ касалликлар юқори частотада аниқланди, жумладан камқонлик (95%) ва рахит (57%). Перинатал энцефалопатия, гипотрофия ва экссудатив-катарал диатез асосан кичик ёш гуруҳида кузатилди. Ўчоқли пневмония энг кўп учраган клиник шакл бўлди (76%), сегментар пневмония эса каттароқ ёшдаги болаларда кўпроқ қайд этилди. Жамоатда орттирилган инфекция ҳолатларнинг 88%ини, нозокомиал пневмония эса 12%ини ташкил этди. Этиологик қўзғатувчи 50% беморларда аниқланди; энг кўп учраган микроорганизмлар — *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Escherichia coli* ва *Proteus spp.* Касаллик кечиши кўп ҳолларда бир нечта клиник синдромлар билан кечди: кардиореспиратор синдром (95%), интоксикация синдроми (40%), нейротоксикоз (45%), бронхообструктив синдром (28%) ҳамда турли даражадаги нафас етишмовчилиги.

**Хулоса.** Эрта ёшдаги болаларда ўткир пневмония оғир клиник намоёнлар билан кечади, айниқса бир ёшгача бўлган болаларда ўта оғир шакллар, нафас етишмовчилиги ва нейротоксик асоратлар кўпроқ кузатилади. Ҳамроҳ патологиянинг юқори тарқалганлиги касаллик кечиши ва оғирлигига сезиларли таъсир кўрсатади. Олинган

натижалар эрта ташхис қўйиш ва интоксикация даражаси, ҳамроҳ синдромлар ҳамда фон касалликларни ҳисобга олган ҳолда комплекс даволаш чораларини амалга ошириш зарурлигини кўрсатади.

**Калит сўзлар:** ўткир пневмония, эрта ёшдаги болалар, нафас етишмовчилиги, кардиореспиратор синдром, нейротоксикоз, ҳамроҳ патология, камқонлик, рахит, болалар пульмонологияси.

**Introduction.** Acute pneumonia remains one of the most common and clinically significant infectious diseases in early childhood. According to various studies, infants in their first year of life are particularly susceptible to severe forms of the disease due to the anatomical and physiological characteristics of the respiratory system, immaturity of the immune response, and a high prevalence of comorbid conditions [4, 8].

It has been established that anemia, rickets, perinatal central nervous system injury, malnutrition, and exudative–catarrhal diathesis significantly aggravate the course of pneumonia and contribute to the development of complications and a protracted inflammatory process [6, 7].

The clinical course of acute pneumonia in young children is characterized by polymorphism of manifestations and a frequent development of cardiorespiratory syndrome, respiratory failure, neurotoxicosis, and other complications [1]. Moreover, the high degree of endogenous intoxication observed in this patient population is determined not only by the activity of the inflammatory process but also by reduced detoxification capacity, enzymatic insufficiency, tissue hypoxia, and metabolic disturbances [3].

At present, a comprehensive analysis of the clinical features of pneumonia according to the child's age, the nature of underlying pathology, and the severity of the condition at hospital admission remains highly relevant. Such an approach is essential for timely diagnosis, accurate prognosis, and the selection of adequate therapeutic strategies [2, 5, 7].

**The aim of the study.** To assess the clinical and functional status of young children with acute pneumonia depending on age group, disease severity, and underlying comorbid conditions.

**Materials and methods**

The study was conducted at the Department of Pediatric Pulmonology of Clinic I and the Central Research Laboratory of the Tashkent Medical Academy. The analysis included 100 children aged 6 months to 3 years with acute pneumonia who received inpatient treatment between 2000 and 2004.

The control group consisted of 30 apparently healthy children comparable in age and sex.

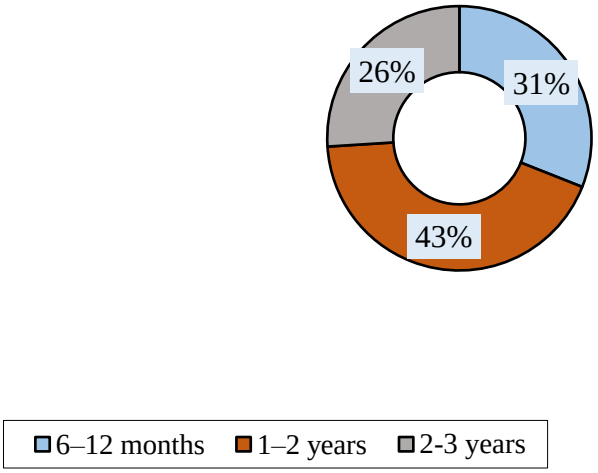


**Figure 1. Distribution of patients by age**

The patients were divided into three age groups:

- **Group I** – 6 months to 1 year (n = 31)
- **Group II** – 1 to 2 years (n = 43)
- **Group III** – 2 to 3 years (n = 26)

The diagnosis was established based on medical history, clinical and laboratory findings, and chest radiography. The severity of the condition, the clinical form of pneumonia, and the timing of hospitalization were recorded at admission.

All patients underwent a standard diagnostic evaluation, including complete blood count, bacteriological examination of nasopharyngeal and oropharyngeal swabs, and radiographic examination of the chest.

**Results**

At the time of hospital admission, the general condition of the patients was assessed as follows: moderate in 14%, severe in 63%, and extremely severe in 23% of cases.

Extremely severe condition was observed predominantly in **Group I** (32.3%), whereas in **Group II** and **Group III**, it accounted for 18.6% and 19.2%, respectively (Table 1).

A severe condition was noted in 67.7%, 69.8%, and 46.1% of patients in Groups I, II, and III, respectively.

Moderate severity was observed only in Groups II and III, accounting for 11.6% and 34.6%, respectively.

Table 1

**Distribution of patients by severity of condition**

| Condition | Total (n=100) | Group I (n=31) | Group II (n=43) | Group III (n=26) |
|---|---|---|---|---|
| Moderate | 14 ± 3.49% | – | 11.6 ± 4.94% | 34.6 ± 9.51% |
| Severe | 63 ± 4.85% | 67.7 ± 8.54% | 69.7 ± 7.09% | 46.1 ± 9.97% |
| Extremely severe | 23 ± 4.23% | 32.3 ± 8.54% | 18.6 ± 6.00% | 19.2 ± 7.58% |

Thus, at the time of hospital admission, children with acute pneumonia most frequently presented in severe or extremely severe condition, particularly those in the first year of life.

A high prevalence of unfavorable background conditions was observed among the studied children. This patient population is known to exhibit increased susceptibility to infections, primarily due to reduced immunological reactivity and metabolic disturbances, including decreased protein-synthetic activity, acidosis, and polyhypovitaminosis.

Medical history revealed that the majority of children with pneumonia had concomitant anemia (95%) and rickets (57%). Perinatal encephalopathy was identified in 4% of cases, hypotrophy in 20%, and exudative–catarrhal diathesis in 12% (Table 2).

All of these factors contribute to metabolic imbalance, impaired enzymatic activity, reduced vitamin levels, and diminished immunological reactivity and overall resistance. Consequently, they increase susceptibility to various diseases, including pneumonia, and in the event of its development, predispose to a prolonged and complicated course of the inflammatory process.

Table 2

**Frequency and pattern of concomitant pathology in young children with acute pneumonia**

| Concomitant disease | Age groups | | | | | |
|---|---|---|---|---|---|---|
| | I, n=31 | | II, n=43 | | III, n=26 | |
| | n | % | n | % | n | % |
| Anemia | 30 | 96,7±3,26 | 41 | 95,3±3,26 | 24 | 92,3±5,33 |
| Rickets | 23 | 74,1±7,99 | 27 | 62,7±7,46 | 7 | 26,9±8,87* |
| Perinatal encephalopathy | 20 | 64,5±8,74 | 18 | 41,8±7,61 | 3 | 11,5±6,38* |
| Seizures | 4 | 12,9±6,12 | 4 | 9,3±4,48 | 4 | 15,4±7,22 |
| Hypotrophy | 17 | 54,8±9,09 | 2 | 4,5±3,19* | 1 | 19,2±7,88* |
| Exudative–catarrhal diathesis | 11 | 35,5±8,74 | 1 | 2,3±2,31* | 0 | 0* |

*Note: * – statistically significant differences compared with Group I (P < 0.05).*

The analysis of concomitant diseases revealed a markedly high prevalence of unfavorable background conditions among children with acute pneumonia, with a clear predominance in the youngest age group (6 months to 1 year). These findings highlight the important role of premorbid status in determining both susceptibility to infection and the severity of disease progression.

Anemia was identified in the overwhelming majority of patients across all age groups (96.7%, 95.3%, and 92.3%, respectively), with no statistically significant differences between groups. This consistently high prevalence suggests that anemia represents a universal background condition in this patient population. Given its known effects on oxygen transport and tissue oxygenation, anemia likely contributes substantially to the development and aggravation of respiratory failure in children with pneumonia, regardless of age.

In contrast, other comorbid conditions demonstrated a clear age-dependent distribution. Rickets was significantly more common in Group I (74.1%) compared to Group III (26.9%, $p<0.05$), indicating a strong association with younger age. This pattern may reflect nutritional

deficiencies and increased metabolic demands during infancy. The presence of rickets is clinically relevant, as it is associated with impaired calcium-phosphorus metabolism, muscle hypotonia, and reduced chest wall compliance, all of which may exacerbate respiratory dysfunction.

A similar trend was observed for perinatal encephalopathy, which was detected in 64.5% of children in Group I, decreasing significantly to 11.5% in Group III ($p<0.05$). This finding suggests that neurological immaturity and prior perinatal central nervous system injury play a substantial role in early childhood, potentially contributing to impaired respiratory regulation, decreased protective reflexes, and an increased risk of severe disease.

Hypotrophy also showed a pronounced predominance in the youngest age group (54.8%), with a statistically significant decrease in Group II (4.5%, $p<0.05$). This reflects the vulnerability of infants to nutritional deficiencies and their impact on immune competence and overall resistance. Malnutrition is known to impair both innate and adaptive immunity, thereby increasing susceptibility to infections and prolonging the inflammatory process.

Exudative–catarrhal diathesis was observed primarily in Group I (35.5%) and was almost absent in older children, further emphasizing the role of age-related immunological and allergic predisposition. This condition may contribute to increased mucosal reactivity and a tendency toward prolonged or complicated inflammatory responses in the respiratory tract.

In contrast, the incidence of seizures did not show significant variation across age groups, remaining relatively low and comparable (approximately 10–15%). This suggests that seizures are less directly associated with age-related background conditions and may instead reflect acute complications such as neurotoxicosis or febrile responses.

Overall, the data demonstrate that while anemia is a common and consistent comorbidity across all age groups, most other unfavorable background conditions are significantly more prevalent in infants. This clustering of multiple risk factors in younger children likely explains the higher frequency of severe and complicated forms of pneumonia observed in this group. The combined presence of metabolic, nutritional, and neurological impairments creates a state of reduced physiological reserve, thereby predisposing to rapid disease progression and multisystem involvement.

These findings underscore the importance of comprehensive assessment of comorbid conditions in young children with pneumonia, particularly in the first year of life. Early identification and correction of such background factors may play a critical role in improving clinical outcomes and reducing the risk of complications.

Table 3

**Frequency of acute pneumonia forms according to classification (%)**

| Forms | Total (n=100) | Group I (n=31) | Group II (n=43) | Group III (n=26) |
|---|---|---|---|---|
| Focal | 76 ± 4.29 | 83.9 ± 6.71 | 72.9 ± 6.86 | 73.1 ± 8.87 |
| Segmental | 14 ± 3.49 | 9.6 ± 5.38 | 13.9 ± 5.34 | 19.2 ± 7.88 |
| Focal-confluent | 10 ± 3.01 | 6.4 ± 4.47 | 11.6 ± 4.94 | 11.5 ± 6.38 |
| Lobar | 0 | 0 | 0 | 0 |
| Interstitial | 0 | 0 | 0 | 0 |

| Forms | Total (n=100) | Group I (n=31) | Group II (n=43) | Group III (n=26) |
|---|---|---|---|---|
| Acute | 100 ± 0 | 100 ± 0 | 100 ± 0 | 100 ± 0 |
| Prolonged | – | – | – | – |
| Complicated | 100 ± 0 | 100 ± 0 | 83.7 ± 5.69* | 80.9 ± 7.86* |
| Community-acquired | 88 ± 3.27 | 100 ± 0 | 100 ± 0 | 100 ± 0 |
| Nosocomial | 12 ± 3.27 | 19.3 ± 7.21 | 9.3 ± 4.48 | 7.6 ± 5.3 |

*Note: * – statistically significant differences compared with Group I (P < 0.05).*

All hospitalized children had complicated forms of pneumonia. Focal pneumonia predominated (76%), with comparable distribution across age groups (83.9%, 72.9%, and 73.1%, respectively).

Segmental pneumonia was diagnosed in 14% of patients, with age-specific distribution of 9.6%, 13.9%, and 19.2% in Groups I, II, and III, respectively, indicating an increase in frequency with advancing age.

According to the modern classification, community-acquired and nosocomial infections play a leading role in the etiopathogenesis of pneumonia. In the present study, community-acquired infection predominated (88%) and was observed with similar frequency across all age groups. Nosocomial infection accounted for 12% of cases and was more common among infants in their first year of life.

Epidemiological, clinical, and conventional radiological and laboratory criteria may, in some cases, suggest a probable etiological diagnosis (e.g., pneumococcal, staphylococcal pneumonia). However, these criteria are insufficient to reliably identify the causative pathogen in an individual case.

Microbiological studies were performed in 50 patients: 11 in Group I, 25 in Group II, and 14 in Group III. In most cases, etiological clarification became possible only from the second week of illness or retrospectively. Overall, an etiological agent was identified in 50% of the examined patients, predominantly in Groups I and II (27.3% and 32%, respectively).

The isolated microorganisms included *Streptococcus pneumoniae*, *Proteus spp.*, *Escherichia coli*, and *Staphylococcus aureus*.

The severity of pneumonia in young children is largely обусловлена вовлечением в патологический процесс других органов и систем, manifesting as various clinical syndromes (Table 4). The principal syndromes observed were cardiorespiratory syndrome, bronchial obstruction syndrome, toxic syndrome, cardiovascular insufficiency, and neurotoxicosis.

Cardiorespiratory syndrome was identified in 95% of patients, with similar frequency across all age groups. Bronchial obstruction syndrome was detected in 28% of cases, also relatively evenly distributed among age groups.

Respiratory failure of grades I, II, and III was observed in 29%, 41%, and 12% of patients, respectively. It was most prevalent among children in the first year of life (96.7%), compared with 65.3% in Group III. Severe respiratory failure was particularly characteristic of infants in their first year of life.

Table 4

**Frequency of clinical syndromes in acute pneumonia (%)**

| Associated syndromes | Group I (n=31) | Group II (n=43) | Group III (n=26) | Total (n=100) |
|---|---|---|---|---|
| | n | % | n | % |
| Cardiorespiratory syndrome (CRS) | 30 | 96.7 ± 3.26 | 40 | 93.3 ± 3.86 |
| Broncho-obstructive syndrome (BOS) | 10 | 25.3 ± 7.94 | 10 | 23.2 ± 6.51 |
| Neurotoxicosis | 11 | 35.4 ± 8.73 | 21 | 48.8 ± 7.71 |
| Toxic syndrome | 12 | 38.7 ± 8.89 | 20 | 46.5 ± 7.7 |
| Dyspeptic syndrome | 8 | 25.8 ± 7.98 | 18 | 41.8 ± 7.61 |
| Cardiovascular insufficiency | 7 | 22.5 ± 7.62 | 7 | 16.2 ± 5.68 |
| Respiratory failure grade I | 9 | 29.0 ± 8.26 | 15 | 34.8 ± 2.35 |
| Respiratory failure grade II | 15 | 48.8 ± 9.12 | 18 | 41.9 ± 7.61 |
| Respiratory failure grade III | 6 | 19.3 ± 9.21 | 2 | 4.6 ± 3.23 |

The analysis of associated clinical syndromes in children with acute pneumonia demonstrates a high frequency of systemic involvement, confirming that the disease in early childhood extends beyond isolated pulmonary pathology and affects multiple organ systems.

Cardiorespiratory syndrome (CRS) was the most prevalent condition, identified in 96.7% of children in Group I and 93.3% in Group II, indicating its almost universal presence regardless of age. This finding reflects the тесную взаимосвязь between respiratory and cardiovascular systems in young children, where impairment of pulmonary function rapidly leads to circulatory disturbances. The consistently high frequency of CRS underscores its central role in the pathogenesis and clinical severity of pneumonia.

Broncho-obstructive syndrome (BOS) was observed in approximately one-quarter of patients in both groups (25.3% and 23.2%, respectively), without significant age-related differences. This suggests that bronchial obstruction is a common but not dominant feature of pneumonia in early childhood and may depend more on individual airway reactivity than on age alone.

Neurotoxicosis and toxic syndrome were also frequently identified, affecting 35.4% and 38.7% of children in Group I and increasing to 48.8% and 46.5% in Group II, respectively. The relatively high prevalence of these syndromes reflects the significant role of systemic intoxication and hypoxia in the disease process. The increase in neurotoxicosis in older children may be associated with a more pronounced systemic inflammatory response or differences in clinical recognition and diagnosis.

Dyspeptic syndrome was present in 25.8% of children in Group I and increased to 41.8% in Group II, indicating a tendency toward greater gastrointestinal involvement with age. This may be explained by the combined effects of intoxication, hypoxia, and нарушения нейрогуморальной регуляции, leading to impaired gastrointestinal function.

Cardiovascular insufficiency was identified in 22.5% of children in Group I and 16.2% in Group II, suggesting a moderate but clinically significant level of circulatory compromise.

Although slightly more frequent in younger children, the difference between groups is not pronounced, indicating that cardiovascular involvement is a common component of severe pneumonia across age categories.

Particular attention should be paid to the distribution of respiratory failure severity. Respiratory failure of grade I was observed in 29.0% of children in Group I and 34.8% in Group II, while grade II respiratory failure was the most common, affecting 48.8% and 41.9% of patients, respectively. Notably, severe respiratory failure (grade III) was considerably more frequent in Group I (19.3%) compared to Group II (4.6%), indicating that infants are at significantly higher risk of developing life-threatening respiratory impairment. This finding is consistent with the known physiological limitations of the respiratory system in early infancy, including reduced functional reserves and rapid decompensation under stress.

Overall, the presented data demonstrate that acute pneumonia in young children is characterized by a high frequency of multisystem involvement, with cardiorespiratory dysfunction, intoxication, and respiratory failure being the dominant clinical features. The greater severity of respiratory failure observed in infants further supports the conclusion that the first year of life represents a particularly vulnerable period, requiring heightened clinical vigilance and early intensive management.

**Discussion**

The present study provides a detailed analysis of the clinical presentation and respiratory functional changes in young children with acute pneumonia, with particular emphasis on age-related differences and the role of comorbid conditions. The findings indicate that the majority of patients were admitted in severe or extremely severe condition, especially among infants in their first year of life. This observation is consistent with existing evidence suggesting that early childhood is associated with an increased risk of severe pneumonia due to anatomical and physiological immaturity of the respiratory system, as well as an underdeveloped immune response.

A key finding of this study is the high prevalence of concomitant conditions, particularly anemia and rickets. These comorbidities were observed in the vast majority of patients and were especially common in younger children. Such conditions are known to impair oxygen transport, disrupt metabolic processes, and reduce overall immunological resistance. As a result, they may significantly aggravate the course of pneumonia and contribute to the development of severe and complicated forms of the disease. The higher frequency of these background conditions in infants may partly explain the greater severity of clinical manifestations observed in this age group.

The predominance of severe and extremely severe forms of pneumonia among children under one year of age can be explained by several pathophysiological factors. These include anatomically narrow airways, decreased lung compliance, insufficient surfactant production, and functional immaturity of central respiratory regulation. Together, these factors limit the compensatory capacity of the respiratory system and predispose young children to rapid progression of respiratory insufficiency. In addition, systemic intoxication and metabolic disturbances play a crucial role in the development of both respiratory failure and neurotoxic complications, further worsening the clinical condition.

The study also demonstrated that focal pneumonia was the most common clinical form across all age groups, while segmental pneumonia was more frequently observed in older

children. This distribution may reflect age-related differences in the structure and function of the bronchopulmonary system, as well as variations in the spread of the inflammatory process within lung tissue. The predominance of community-acquired pneumonia is in line with general epidemiological patterns, whereas the presence of nosocomial cases, particularly among younger patients, may be associated with increased vulnerability and longer hospital stays.

An important aspect of this study is the relatively low rate of etiological verification, with causative pathogens identified in only half of the examined patients. This finding highlights the limitations of conventional microbiological methods and reflects common challenges in routine clinical practice, including prior antibiotic use and delayed diagnostic procedures. Despite these limitations, the spectrum of identified pathogens is consistent with commonly reported bacterial agents in pediatric pneumonia.

The high frequency of clinical syndromes, particularly cardiorespiratory syndrome, respiratory failure, and neurotoxicosis, underscores the systemic nature of acute pneumonia in young children. Respiratory failure of varying severity was observed in a substantial proportion of patients and was most pronounced in infants. Neurotoxic manifestations, likely associated with hypoxia and endogenous intoxication, were also common and contributed to the overall severity of the disease. These findings emphasize the need for careful monitoring of multiple organ systems in affected children.

From a clinical perspective, the results of this study highlight the importance of early identification of high-risk patients. Children under one year of age, especially those with anemia, rickets, and signs of malnutrition, should be considered particularly vulnerable to severe disease and complications. Timely hospitalization, comprehensive diagnostic evaluation, and an integrated therapeutic approach are essential for improving outcomes in this population.

Several limitations of the present study should be acknowledged. The data were collected over an earlier time period, which may limit the applicability of the findings to current clinical practice, given advances in diagnostic methods and treatment strategies. In addition, the limited rate of pathogen identification restricts the ability to draw definitive conclusions regarding the etiological structure of pneumonia. The absence of modern diagnostic techniques, such as molecular methods, may have further influenced the results. Nevertheless, the study provides valuable insights into the clinical course of acute pneumonia in young children and underscores the significant role of comorbid conditions in determining disease severity.

**Conclusion**

Acute pneumonia in young children remains a clinically severe and multifactorial condition, particularly in infants during the first year of life, who demonstrate the highest risk of extremely severe disease, respiratory failure, and neurotoxic complications. The findings of this study confirm that the course of pneumonia in this age group is largely determined not only by the infectious process itself but also by the high prevalence of underlying comorbid conditions, such as anemia, rickets, and malnutrition, which significantly compromise physiological reserves and adaptive capacity.

The predominance of severe clinical forms, together with the high frequency of cardiorespiratory and neurotoxic syndromes, underscores the systemic nature of the disease and the need for early recognition of clinical deterioration. Particular attention should be given

to infants presenting with unfavorable background conditions, as they constitute a high-risk group requiring prompt hospitalization, close monitoring, and comprehensive management.

The relatively low rate of etiological verification observed in this study highlights the ongoing limitations of routine diagnostic approaches and emphasizes the importance of improving microbiological and molecular diagnostic capabilities in pediatric practice. Enhanced identification of causative pathogens may contribute to more targeted and effective therapeutic strategies.

Importantly, the results of this study have direct clinical implications. Early risk stratification based on age and comorbid status should be integrated into clinical decision-making to optimize treatment outcomes. A multidisciplinary and individualized approach, taking into account the severity of intoxication, respiratory dysfunction, and associated syndromes, is essential for reducing complications and improving prognosis in young children with acute pneumonia.

Overall, these findings reinforce the need for heightened clinical vigilance, timely diagnosis, and комплексного терапевтического подхода in the management of acute pneumonia in early childhood, particularly in vulnerable patient populations.

**Research Transparency**

The authors declare full transparency in the conduct and reporting of this study. The research was performed in accordance with generally accepted ethical principles for biomedical studies involving children. All diagnostic and therapeutic procedures were carried out within the framework of standard medical care. Parents or legal guardians of the children were informed about the examinations and treatment provided.

The authors confirm that the data presented in this manuscript are reliable and original and have not been previously published, either in whole or in part, in other publications. All stages of the study, including data collection, processing, and analysis, were performed by the authors and are reported without distortion or misrepresentation of the results.

**Declaration of Financial and Other Relationships**

The authors declare that there is no conflict of interest related to the publication of this article.

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