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METABOLIC DISTURBANCES IN SEVERE PNEUMONIA IN CHILDREN: CLINICAL AND PROGNOSTIC SIGNIFICANCE

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Background. Severe pneumonia in children is accompanied by a systemic inflammatory response, hypoxemia, and impaired microcirculation. Under conditions of reduced oxygen delivery, cellular metabolism shifts to the anaerobic pathway, which is accompanied by lactate accumulation, the development of metabolic acidosis, and stress-induced hyperglycemia. International guidelines for the management of sepsis and septic shock in children regard lactate level as one of the markers of disease severity and a benchmark for guiding fluid therapy [1]. The clinical significance of the problem is confirmed by the frequency of adverse outcomes: in a cohort of 617 children with severe pneumonia admitted to the intensive care unit, 28-day mortality was 9.40% [2]. The incidence of severe community-acquired pneumonia increases with age – from 7.37% at 1-3 years to 12.80% at 4-6 years and 18.04% at 7-12 years [3]. At the same time, individual metabolic parameters have mostly been studied in isolation, and their comparative prognostic value has not been systematically summarized.

Aim of the study. To assess the comparative clinical and prognostic significance of metabolic disturbances in children with severe pneumonia based on a synthesis of current clinical data.

Materials and methods. An analytical review of clinical studies was performed. The search was conducted in the PubMed/MEDLINE, PLOS, Frontiers, and Springer Link databases for publications from 2018–2025. Inclusion criteria: (a) study population – children aged 0-18 years with severe pneumonia or sepsis; (b) at least one metabolic parameter quantitatively assessed; (c) results reported with a 95% confidence interval (CI), AUC value, or p-level. Five clinical studies and one consensus document were included in the analysis, together covering more than 2,400 patients. Indicators were interpreted as hazard ratio (HR), odds ratio (OR), and area under the ROC curve (AUC).

Results and discussion. The analyzed data allow metabolic disturbances to be divided into four groups according to mechanism and prognostic value (Table).

1. Hyperlactatemia and the lactate-to-albumin ratio. Lactate remains the most extensively studied marker of tissue hypoperfusion. In a cohort of 617 children with severe pneumonia, each unit increase in log(lactate/albumin) increased the risk of death 2.51-fold (HR = 2.51; 95% CI 1.73–3.65; $p<0.001$), and

the highest tertile compared with the lowest yielded HR = 2.52 (95% CI 1.17-5.46; p for trend = 0.015) [2]. At the same time, a single lactate measurement at admission has limited prognostic value: in a prospective cohort of children with severe sepsis (n=46), baseline lactate did not differ between survivors and non-survivors, whereas the level at 6 hours and lactate clearance below 10% were significantly associated with mortality ($p<0.05$); the sensitivity of 6-hour clearance was 62.3%, and specificity was 60.4% [4]. Thus, it is not the absolute lactate level but its dynamics that are clinically informative.

2. Albumin-based markers and age stratification. In a propensity-matched cohort of 1,071 children, the optimal prognostic indicator was found to differ by age: at 1-3 and 4-6 years, the neutrophil percentage-to-albumin ratio (NPAR) had the highest accuracy, while at 7-12 years the C-reactive protein-to-albumin ratio (CAR) was most accurate. NPAR threshold values were also age-dependent: 1.26 at 1-3 years and 1.57 at 4-6 years [3]. This indicates that uniform threshold values cannot be applied across all age groups.

3. Protein-energy status. Admission prealbumin level determined the length of hospital stay: in an analysis of 163 children with severe Mycoplasma pneumonia, length of stay in the lowest quartile (≤ 10.86 mg/dL) was 18.53 days, compared with 11.48 days in the highest quartile (> 20.73 mg/dL) (β = –0.025; 95% CI –0.048…–0.002; p = 0.032). Higher prealbumin levels were also associated with a reduced risk of severe disease according to the PRISM III score (OR = 0.846; 95% CI 0.773-0.926; $p < 0.001$) [5]. The difference between the extreme quartiles amounts to 7.05 days, or 61% in relative terms.

4. Anemia and oxygen transport. In a case-control study involving 200 children, anemia was found in 74% of patients versus 38% in controls; the presence of iron-deficiency anemia increased the odds of lower respiratory tract infection 4.75-fold, and in cases of recurrent infection the odds ratio reached 10.26 [6]. Thus, anemic syndrome acts not as a concomitant condition but as an independent factor aggravating tissue hypoxia.

Table. Prognostic value of metabolic parameters in severe pneumonia in children

Parameter	Outcome	Effect estimate	n	source
Lactate/albumin (log)	28-day mortality	HR = 2,51 (1,73–3,65)	617	[2]
Lactate/albumin, highest tertile	28-day mortality	HR = 2,52 (1,17–5,46)	617	[2]
Lactate clearance < 10 % за 6 ч	Mortality	Se 62,3% / Sp 60,4%	46	[4]

Parameter	Outcome	Effect estimate	n	source
NPAR, 1-3 years	Severe course	threshold 1,26	1 071	[3]
NPAR, 4-6 years	Severe course	threshold 1,57	1 071	[3]
CAR, 7-12 years	Severe course	threshold 0,48	1 071	[3]
Prealbumin ≤ 10,86 мг/дл	Length of treatment	18,53 vs 11,48 days	163	[5]
Prealbumin (increase)	PRISM III severity	OR = 0,846 (0,773-0,926)	163	[5]
Iron-deficiency anemia	Lower respiratory tract infection	OR = 4,75	200	[6]

Conclusion. Metabolic disturbances in severe pneumonia in children carry independent prognostic value, although this value is not uniform. The strongest association with mortality is shown by the lactate-to-albumin ratio (HR = 2.51), with the dynamics of lactate – rather than a single admission measurement – being the informative parameter. The strongest association with length of treatment is shown by prealbumin, with the difference between extreme quartiles reaching 7 days. Threshold values for albumin-based markers are age-dependent and cannot be applied universally. Comprehensive assessment of lactate dynamics, albumin, prealbumin, and oxygen transport indicators allows risk stratification already at admission and targeted adjustment of intensive care. These findings provide a basis for planning an original prospective study in an intensive care unit setting.

Keywords: severe pneumonia, children, PICU, hyperlactatemia, lactate-to-albumin ratio, prealbumin, tissue hypoxia, prognostic criteria.

References

1. Weiss S.L., Peters M.J., Alhazzani W. et al. Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children // Pediatr Crit Care Med. – 2020. – Vol.21, №2. – P.e52-e106.
2. Zhang Y., Guo R., Wang L., Hu J. Association between lactate-to-albumin ratio and 28-day ICU mortality in pediatric severe pneumonia patients // PLOS ONE. – 2025. – Vol.20, №9. – e0331486.
3. Bai Y., Zhang J., Hou C. Age-stratified selection of albumin-based inflammatory ratios: a novel strategy for optimizing risk prediction of severe pneumonia in children // Front Pediatr. – 2025. – Vol.13. – Art. 1679957.
4. Abdelaziz T.A., Karam N.A., Ismail W.I. et al. Lactate dynamics in paediatric patients with severe sepsis: insights from a prospective cohort study // BMC Pediatr. – 2024. – Vol.24. – Art. 345.
5. Wang C., Song C., Wang S., Liu G. Prealbumin May Predict Clinical Outcomes in Children with Severe Mycoplasma pneumoniae Pneumonia // Iran J Pediatr. – 2020. – Vol.30, №1. – e97680.
6. Iron-deficiency anemia as a risk factor for acute lower respiratory tract infections in children younger than 5 years // Egypt J Bronchol. – 2018. – Vol. 12, №3. – P.352-357.