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ABSTRACT

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INFORMATION ON PROGNOSTIC MARKERS OF SEVERE ACUTE BRONCHITIS IN PRESCHOOLERS: A STUDY IN SUMY REGION IN NORTH-EASTERN UKRAINE

Introduction. Respiratory infections, especially in children, are a significant global health concern. Understanding the implications of respiratory infections like acute bronchitis is crucial for devising effective management strategies. These infections, including bronchitis, pneumonia, and influenza, contribute substantially to pediatric hospitalizations. Predicting the severity of acute bronchitis in children is essential for personalized treatment and resource allocation. Developing reliable prognostic tools for acute bronchitis can improve outcomes and optimize healthcare resource utilization.

Methods. The study spanned four years (2018–2021) at "Saint Zinaida's Children's Clinical Hospital" and "Primary Health Care Center No. 2" in Sumy City Council. It involved 135 preschool children with acute bronchitis (study group) and 28 healthy children (control). The control group matched the age and gender of the acute bronchitis group. Inclusion criteria comprised parental consent, ages 3–6, and a diagnosis of acute bronchitis; exclusions included parental refusal, ages below 3 or above 7, concurrent somatic or allergic diseases, non-compliance, and diagnoses other than acute bronchitis. Various methods were employed, including clinical, laboratory, instrumental, and statistical analyses. The severity of acute bronchitis was gauged using the BSS-ped clinical tool. Immunological status assessment involved determining cellular immunity indicators via enzyme-linked immunosorbent assay. Hormonal status analysis included thyroid and cortisol levels via enzyme-linked immunosorbent assay. Statistical analysis utilized SPSS 26 and probabilistic modeling based on Bayes' theorem for building prognostic models and assessing risk factors for acute bronchitis. Fisher's criterion determined reliability at a significance level of 0.05, categorizing risk degrees from low to critically high based on a posteriori chances.

Results. The study successfully identified key clinical, anamnestic, hormonal, and immunological risk factors for severe acute bronchitis in preschoolers, constructing a predictive mathematical model. Breastfeeding and mixed feeding in infants were not associated with increased severity, contrasting with chronic upper respiratory tract disease and parental habits, notably smoking, linked to heightened severity. Cough severity and auscultatory wheezing, with a BSS-ped score of 4, moderately impacted severe acute bronchitis. An outlined prognostic model confirmed hormonal indicators' influence, particularly elevated reverse triiodothyronine levels, on increased risk. Immune cellular activity, specifically CD8+, CD4+, and CD22+, demonstrated pronounced impacts on severe acute bronchitis in preschoolers. A combined aberration of CD3+ and free triiodothyronine, CD3+ and total triiodothyronine, or CD4+ and free triiodothyronine indicated a critically high risk. The model's reliability was affirmed via ROC analysis, displaying a sensitivity of 91.7 %, specificity of 68.2 %, and an AUC of 0.869, indicating its high quality.

Conclusions. In summary, chronic upper respiratory tract disease and parental smoking, particularly when both parents smoke, are significant clinical and anamnestic risk factors for severe acute bronchitis in preschoolers. Cough severity and wheezing on the BSS-ped scale contribute to its development. Hormonal indicators, especially reverse triiodothyronine, display notable impacts, with weaker associations observed for total triiodothyronine and cortisol. Immunological status indicators such as CD22+, CD4+, and CD8+ are also linked to severe acute bronchitis. Combinations of altered CD4+ and free triiodothyronine, CD3+ and free triiodothyronine, CD3+ and total triiodothyronine intensify the risk. When evaluating preschoolers with acute bronchitis, attention to clinical history (chronic upper respiratory disease, parental smoking, severe cough, and pulmonary rales) and specific laboratory parameters (concentration of triiodothyronine, cortisol, and serum levels of CD22+, CD4+, and CD8+) is advisable.

Keywords: acute bronchitis, children, bronchopulmonary diseases, hormones, triiodothyronine, thyroxine, cortisol, immunity.

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РЕЗЮМЕ

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ІНФОРМАЦІЯ ПРО ПРОГНОСТИЧНІ МАРКЕРИ ТЯЖКОГО ГОСТРОГО БРОНХІТУ В ДІТЕЙ ДОШКІЛЬНОГО ВІКУ: ДОСЛІДЖЕННЯ В СУМСЬКІЙ ОБЛАСТІ НА ПІВНІЧНОМУ СХОДІ УКРАЇНИ

Вступ. Респіраторні інфекції, особливо у дітей, є значною проблемою охорони здоров'я у всьому світі. Розуміння наслідків респіраторних інфекцій, таких як гострий бронхіт, має вирішальне значення для розробки ефективних стратегій лікування. Ці інфекції, включаючи бронхіт, пневмонію та грип, є основною причиною госпіталізації дітей. Прогнозування тяжкості гострого бронхіту у дітей має важливе значення для персоналізованого лікування та розподілу ресурсів. Розробка

надійних інструментів прогнозування тяжкості перебігу гострого бронхіту може покращити результати лікування та оптимізувати використання ресурсів охорони здоров'я.

Методи дослідження. Дослідження тривало чотири роки (2018-2021) на базі Комунального некомерційного підприємства "Дитяча клінічна лікарня Святої Зінаїди" та Комунального некомерційного підприємства "Центр первинної медико-санітарної допомоги № 2" Сумської міської ради. У ньому взяли участь 135 дітей дошкільного віку з гострим бронхітом (основна група) та 28 здорових дітей (контрольна група). Контрольна група відповідала за віком і статтю групі хворих на гострий бронхіт. Критеріями включення були: згода батьків, вік 3-6 років і діагноз гострого бронхіту; виключення – відмова батьків, вік молодше 3 або старше 6 років, супутні соматичні або алергічні захворювання, недотримання правил і діагнози, відмінні від гострого бронхіту. Були використані різні методи, включаючи клінічні, лабораторні, інструментальні та статистичні аналізи. Тяжкість гострого бронхіту оцінювали за допомогою клінічного інструменту BSS-ped. Оцінка імунологічного статусу включала визначення показників клітинного імунітету методом імуноферментного аналізу. Аналіз гормонального статусу включав визначення рівня тиреотропного гормону та кортизолу за допомогою імуноферментного аналізу. Для статистичного аналізу використовували SPSS 26 та імовірнісне моделювання на основі теореми Баєса для побудови прогностичних моделей і оцінки факторів ризику розвитку гострого бронхіту. Критерій Фішера визначав достовірність на рівні значущості 0,05, класифікуючи ступінь ризику від низького до критично високого на основі апостеріорних шансів.

Результати. У дослідженні успішно визначено ключові клінічні, анамнестичні, гормональні та імунологічні фактори ризику тяжкого перебігу гострого бронхіту у дітей дошкільного віку та побудовано прогностичну математичну модель. Грудне та змішане вигодовування немовлят не були пов'язані зі ступенем тяжкості, на відміну від хронічних захворювань верхніх дихальних шляхів та паління батьків, які були пов'язані з підвищеним ступенем тяжкості. Тяжкість кашлю та аускультативні хрипи з оцінкою 4 бали за шкалою BSS-ped помірно впливали на тяжкість гострого бронхіту. Окреслена прогностична модель підтвердила вплив гормональних показників, зокрема збільшеного рівня реверсивного трийодтироніну, на підвищений ризик. Імунна клітинна активність, зокрема CD8+, CD4+ та CD22+, продемонструвала виражений вплив на тяжкий перебіг гострого бронхіту у дітей дошкільного віку. Комбінована аберація CD3+ і вільного трийодтироніну, CD3+ і загального трийодтироніну або CD4+ і вільного трийодтироніну вказувала на критично високий ризик. Надійність моделі була підтверджена за допомогою ROC-аналізу, який показав чутливість 91,7 %, специфічність 68,2 % та AUC 0,869, що свідчить про її високу якість.

Висновки. Таким чином, хронічні захворювання верхніх дихальних шляхів і паління батьків, особливо коли обоє батьків мають таку шкідливу звичку, є значущими клініко-анамнестичними факторами ризику тяжкого перебігу гострого бронхіту у дітей дошкільного віку. Тяжкість кашлю та хрипи за шкалою BSS-ped сприяють його розвитку. Гормональні показники, особливо реверсивний трийодтиронін, демонструють помітний вплив, при цьому слабші зв'язки спостерігаються для загального трийодтироніну і кортизолу. Показники імунологічного статусу, такі як CD22+, CD4+ та CD8+, також пов'язані з тяжким перебігом гострого бронхіту. Комбінації змінених показників CD4+ і вільного трийодтироніну, CD3+ і вільного трийодтироніну, CD3+ і загального трийодтироніну посилюють ризик. При обстеженні дітей дошкільного віку з гострим бронхітом доцільно звертати увагу на клінічний анамнез (хронічні захворювання верхніх дихальних шляхів, куріння батьків, сильний кашель і легеневі хрипи) та специфічні лабораторні показники (концентрація трийодтироніну, кортизолу та сироваткові рівні CD22+, CD4+ і CD8+).

Ключові слова: гострий бронхіт, діти, бронхолегеневі захворювання, гормони, трийодтиронін, тироксин, кортизол, імунітет.

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ABBREVIATIONS

CAP – community-acquired pneumonia
CRP – C-reactive protein
TSH – thyroid-stimulating hormone
fT3 – free triiodothyronine
fT4 – free thyroxine
NLR – neutrophil-to-lymphocyte ratio
PCT – procalcitonin
rT3 – reverse triiodothyronine
suPAR – soluble urokinase-type plasminogen activator receptor
T3 – total triiodothyronine
T4 – total thyroxine

INTRODUCTION / ВСТУП

Respiratory infections represent a substantial global health burden, affecting individuals across diverse demographics and age groups. Among these, children constitute a vulnerable population due to their developing immune systems and increased susceptibility to respiratory ailments. Acute bronchitis, a prevalent respiratory condition in pediatric populations, remains a pertinent concern owing to its impact on children's health and well-being. Understanding the significance of respiratory infections, specifically acute bronchitis, in children is paramount in elucidating its implications and devising effective management strategies [1-4].

The global prevalence of respiratory infections underscores their significance as a major cause of morbidity and mortality worldwide. Respiratory ailments, including bronchitis, pneumonia, and influenza, collectively contribute to a substantial portion of pediatric hospitalizations and outpatient visits. Children, particularly those under the age of five, are at an elevated risk of developing severe complications from respiratory infections, highlighting the critical need to address these conditions [5–7].

Acute bronchitis in children manifests as an inflammation of the bronchial passages, predominantly triggered by viral infections. Its clinical presentation often includes cough, wheezing, and respiratory distress, posing significant challenges in diagnosis and management. Although acute bronchitis is mostly self-limiting, the potential for progression to more severe respiratory conditions necessitates thorough evaluation and effective intervention [8, 9].

Furthermore, predicting the severity of respiratory illnesses, including acute bronchitis, in children holds paramount importance in providing timely and appropriate medical care. Identifying factors or biomarkers associated with disease progression can aid clinicians in stratifying patients based on their risk profile, enabling personalized treatment approaches and resource allocation. Developing reliable prognostic tools for acute bronchitis in children can mitigate adverse outcomes, reduce unnecessary interventions, and optimize healthcare resource utilization [10–14].

In conclusion, the relevance of respiratory infections, notably acute bronchitis, in children is a pressing concern due to its impact on pediatric health and the healthcare system. Recognizing the significance of these conditions, predicting disease severity, and implementing targeted interventions are crucial in ameliorating the burden of acute bronchitis in pediatric populations.

OBJECTIVE

The study's objective was to determine the predictive markers for severe acute bronchitis in preschool children: clinical (cough and auscultatory pulmonary rales according to the BSS-ped scale), anamnestic (infant feeding, parents' bad habits and chronic pathology of the upper respiratory tract in the immediate family) hormonal (thyroid-stimulating hormone, total triiodothyronine, free triiodothyronine, reverse triiodothyronine, total thyroxine, free thyroxine and cortisol) and immunological risk factors (Lymphocytes, CD3+, CD16+, CD8+, CD4+, CD22+).

MATERIALS AND METHODS

The study was conducted for four years (2018-2021) on the basis of the Municipal Non-Profit Enterprise " Saint Zinaida's Children's Clinical Hospital" of Sumy City Council and the Municipal Non-Profit Enterprise "Primary Health Care Center No. 2" of Sumy City Council. We examined 135 preschool children (3 to 6 years old) with acute bronchitis who were treated in infectious diseases departments (study group) and 28 healthy children (control group).The examined children of the control group corresponded in age and gender to the group of patients with acute bronchitis. The main group was represented by 63 ((46.67 ± 8.42) %) and 72 ((53.33 ± 8.42) %) female and male patients, respectively (p = 0.05). There were 13 girls ((46.43 ± 18.47) %) and 15 boys ((53.57 ± 18.47) %) in the control group (p = 0.05). In the main group, the average age of female patients was (4.32 ± 0.15) years, and of male patients – (4.13 ± 0.13) years, in the control group the average age was (4.38 ± 0.09) and (4.00 ± 0.31) years for female and male patients, respectively. The general condition of the children in the control group was satisfactory, their neuropsychological and physical development was age-appropriate. None of the children in this group had been ill during the last month before the examinations. When taking anamnesis of children in the control group, it was found that complicated pregnancy was noted in 9 ((32.14 ± 8.99) %) mothers: Mild iron deficiency anemia was diagnosed in 3 ((10.71 ± 5.95) %) women, cesarean delivery in 2 ((7.14 ± 4.96) %), toxicosis of the first half of pregnancy in 3 ((10.71 ± 5.95) %) women in labor, and 1 mother ((3.57 ± 3.57) %) reported an acute respiratory viral infection. Prolonged neonatal jaundice was detected in 5 ((17.86 ± 7.37) %) newborns, and perinatal central nervous system damage in 7 ((25.00 ± 8.33) %) children of the control group. The allergic and hereditary history of healthy children was not burdened.

In the children of the main group, the diagnosis was made in accordance with the clinical protocol for the provision of medical care to children in the specialty "Pediatric Pulmonology", approved by the order of the Ministry of Health of Ukraine of 13.01.2005 No. 18, as amended by the Order of the Ministry of Health of Ukraine No. 499 of July 16, 2014 (Unified Clinical Protocol for Primary Care for Adults and Children "Acute Respiratory Infections"), and the Adapted Evidence-Based Clinical Practice Guideline "Influenza and Acute Respiratory Infections", 2014.

The criteria for enrollment in the clinical trial were: informed consent of the sick child's parents to participate in the study and compliance with all doctor's prescriptions; children aged 3 to 6 years; and a primary diagnosis of acute bronchitis. The exclusion criteria were refusal of the parents of the sick child to participate in the study; age of children less than 3 and more than 6 years; presence of concomitant somatic diseases in the stage of decompensation; presence of allergic diseases;

non-compliance with medical prescriptions; patients with a primary diagnosis other than acute bronchitis.

The following methods were used in the study: general clinical, laboratory, instrumental and statistical. The severity of acute bronchitis was assessed using the BSS-ped clinical tool for measuring the severity of acute bronchitis in children.

The study of the immunological status of children was carried out by determining the level of indicators of the cellular immunity (CD3+, CD4+, CD8+, CD16+, CD22+) in the acute period of the disease (1–2 days of hospitalization) in the blood serum by enzyme-linked immunosorbent assay. The hormonal status of children (thyroid-stimulating hormone (TSH), total triiodothyronine (T3), reverse triiodothyronine (rT3), total thyroxine (T4), free thyroxine fraction (fT4) and cortisol) was also determined in the acute period of the disease (days 1–2 of hospitalization) in the blood serum by a solid-phase enzyme-linked immunosorbent assay.

Statistical processing was performed using SPSS 26. To build the prognostic model, we used probabilistic modeling based on Bayes' theorem, which allowed us to move from the available a priori probabilities to a posterior probability distribution depending on the influence of various factors using the average risk function. Reliability is determined on the basis of Fisher's criterion for a significance level of 0.05. The a priori and a posteriori chances were calculated, on the basis of which the degree of increase in the risk of acute bronchitis was determined. The values obtained through the study of probability estimates (based on sequential Wald analysis) are included in prognostic tables according to their informational content. To predict the outcome, based on the a posteriori chances, presented as a percentage, 4 degrees of risk of acute bronchitis were identified: up to 17 % – low; 18–40 % – medium; 41–70 % – high; 71–100 % – critically high.

RESULTS

The study made it possible to identify the most informative clinical, anamnestic, hormonal and immunological risk factors for severe acute bronchitis in preschool children and to build a mathematical model on this basis.

Breastfeeding and mixed feeding of infants is not a risk factor for increasing the severity of acute bronchitis. Instead, chronic upper respiratory tract disease and parents' bad habits are factors that lead to severe acute bronchitis. It should be noted that smoking by both parents causes a higher risk of increasing the severity of acute bronchitis (Table 1). Figure 1 provides a more visual representation.

Table 2 shows that cough with a BSS-ped severity score of 4 and four-point auscultatory wheezing had an average impact on the development of severe acute bronchitis.

To confirm the hypothesis of the influence of hormonal status indicators, their prognostic model is presented (Table 3).

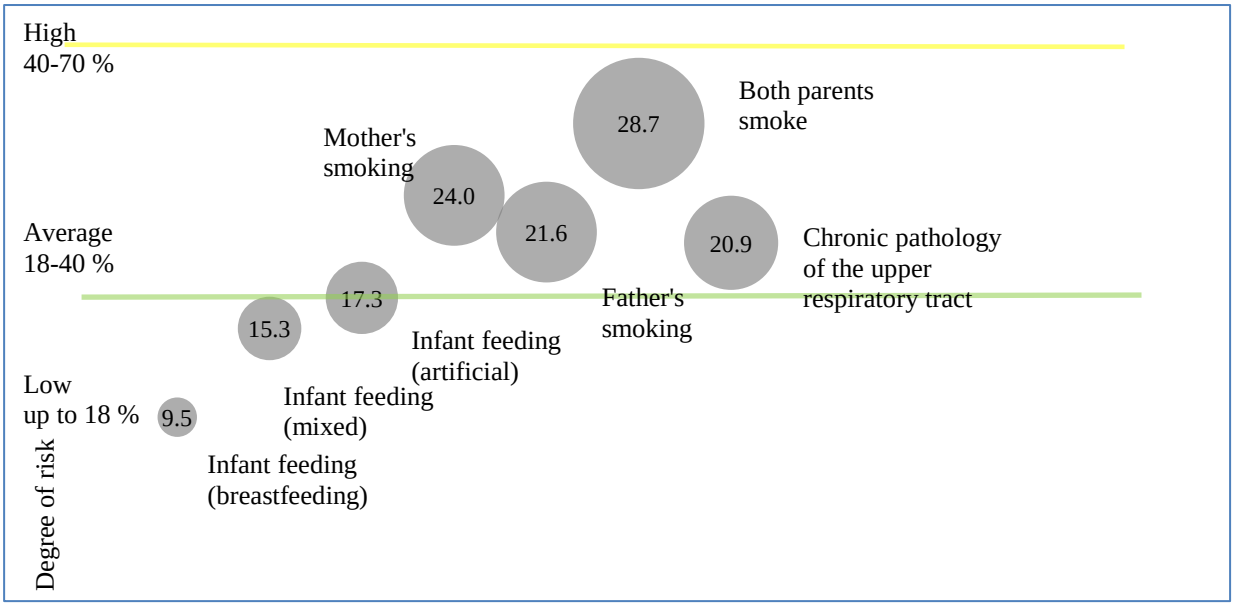


Figure 1 – A posteriori chances of increasing the severity of acute bronchitis in preschool children depending on the life history, %

Table 1 – Prognosis of severe acute bronchitis in preschool children depending on the life history

Factors of influence	**A posteriori chance | %**		**Increase in risk, times**	**Degree of risk: up to 18 – low, 18-40 – average, 40-70 – high, 70-100 – critically high**
Infant feeding (breastfeeding)	0.062	9.5	0.18	Low
Infant feeding (mixed)	0.099	15.3	0.29	Low
Infant feeding (artificial)	0.112	17.3	0.33	Average
Parents' bad habits (mother's smoking)	0.156	24.0	0.46	Average
Parental smoking habits (father's smoking)	0.140	21.6	0.46	Average
Parental smoking habits (both parents smoke)	0.186	28.7	0.60	Average
Chronic pathology of the upper respiratory tract	0.135	20.9	0.43	Average

Table 2 – Prognosis of severe acute bronchitis in preschool children depending on the assessment of cough and auscultatory pulmonary rales according to the BSS-ped scale

Factors of influence	**A posteriori chance | %**		**Increase in risk, times**	**Degree of risk: up to 18 – low, 18-40 – average, 40-70 – high, 70-100 – critically high**
Cough (2 points)	0.031	4.8	0.09	Low
Cough (3 points)	0.056	8.7	0.17	Low
Cough (4 points)	0.124	19.1	0.40	Average
Auscultatory lung rales (2 points)	0.079	12.2	0.23	Low
Auscultatory lung rales (3 points)	0.101	15.6	0.33	Low
Auscultatory lung rales (4 points)	0.164	18.5	0.52	Average

Table 3 – Prognosis of severe acute bronchitis in preschool children depending on hormonal status indicators

Factors of influence	**A posteriori chance | %**		**Increase in risk, times**	**Degree of risk: up to 18 – low, 18-40 – average, 40-70 – high, 70-100 – critically high**
TSH	0.022	3.4	0.07	Low
T4	0.038	5.8	0.11	Low
fT4	0.044	11.2	0.16	Low
T3	0.146	22.6	0.43	Average
Cortisol	0.200	22.5	0.62	Average
rT3	1.631	61.1	2.42	High

An increase in rT3 levels leads to a high risk of severe acute bronchitis. This is clearly shown in Figure 2.

According to the indicators of functional activity of the immune cellular link, we see that the following indicators have a more pronounced effect on the development of severe acute bronchitis in preschool children: CD8+, CD4+ and CD22+ (Table 4, Figure 3).

The cumulative effect of hormonal and immunologic panel parameters is presented in Table 5. As we can see from the calculations, a critically high risk of severe acute bronchitis in preschool children occurs when the abnormal values of CD3+ and fT3, CD3+ and T3, CD4+ and fT3 are combined.

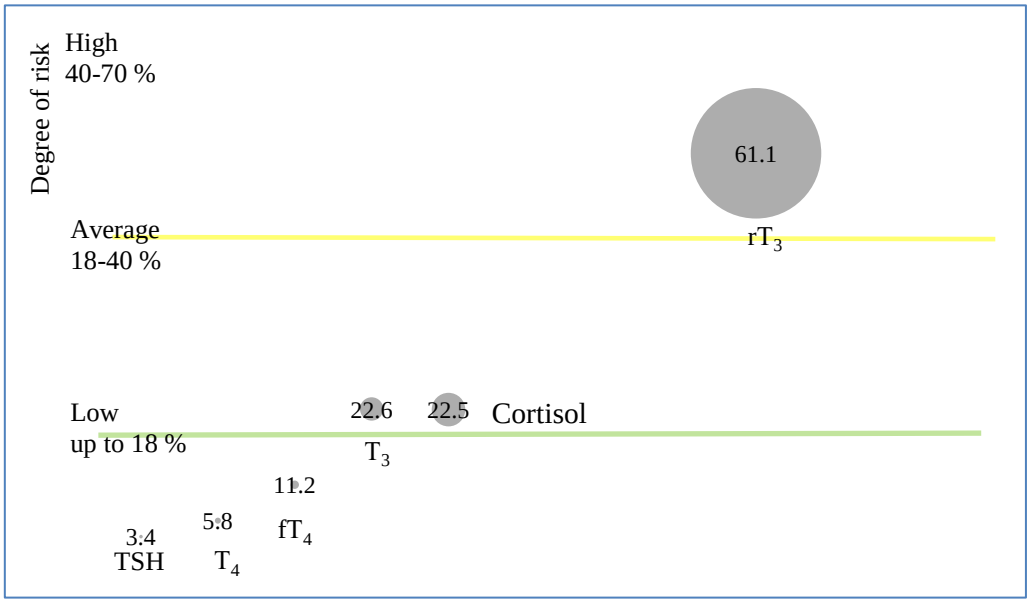


Figure 2 – A posteriori odds of increasing the severity of acute bronchitis in preschool children depending on hormonal status, %

Table 4 – Prognosis of severe acute bronchitis in preschool children according to the functional activity of the cellular immunity link

Factors of influence	**A posteriori chance | %**		**Increase in risk, times**	**Degree of risk: up to 18 – low, 18-40 – average, 40-70 – high, 70-100 – critically high**
Lymphocytes, %	0.073	11.5	0.19	Low
CD3+	0.099	15.7	0.29	Low
CD16+	0.124	18.6	0.34	Average
CD8+	0.153	21.6	0.47	Average
CD4+	0.197	29.6	0.63	Average
CD22+	0.212	32.4	0.68	Average

To verify the reliability of the model's predictive abilities, we used ROC analysis (Figure 4). In our model, the sensitivity is 91.7 %, the specificity is 68.2 %, and the AUC is 0.869, which means that the quality of the model is very good.

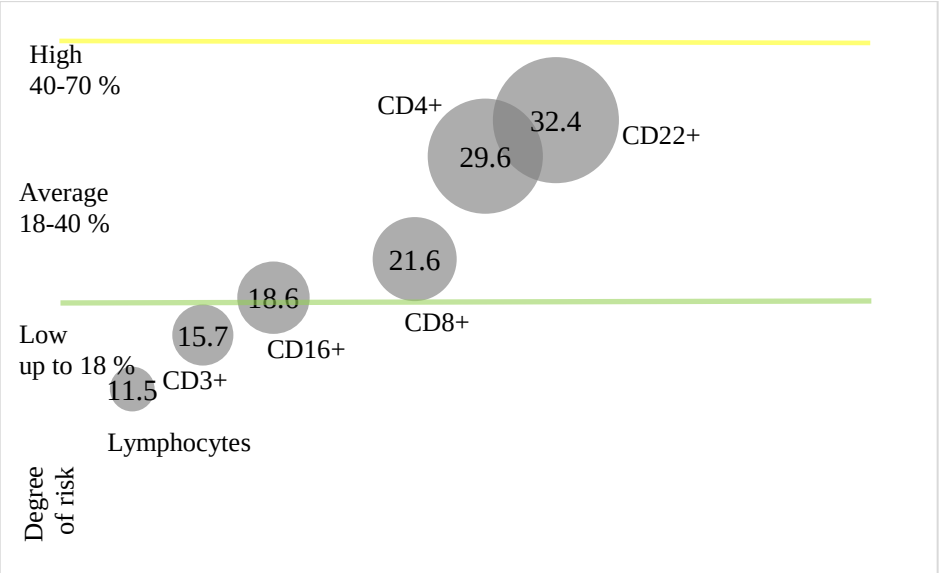
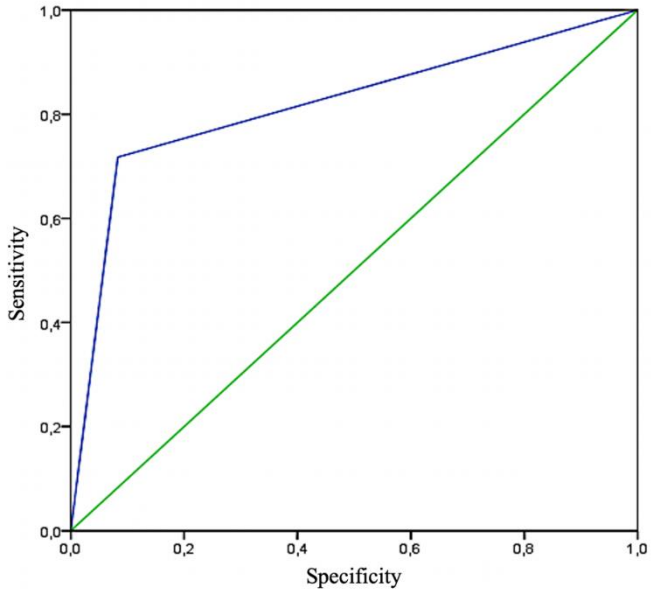


Figure 3 – A posteriori chances of increasing the severity of acute bronchitis in preschool children depending on the functional activity of the cellular immune system, %

Table 5 –Prognosis of severe acute bronchitis in preschool children according to cumulative indicators of functional activity of the cellular immunity and hormonal panel

Factors of influence	**A posteriori chance | %**		**Increase in risk, times**	**Degree of risk: up to 18 – low, 18-40 – average, 40-70 – high, 70-100 – critically high**
CD22+ and rT3	0.141	5.3	0.21	Low
CD22+ and Cortisol	0.369	13.8	0.55	Low
CD22+ and TSH	0.761	28.5	1.13	Average
CD22+ and fT4	0.849	38.0	2.30	Average
CD22+ and T3	0.223	8.4	0.33	Low
CD22+ and fT3	0.451	16.9	0.67	Low
CD16+ and Cortisol	0.348	13.0	0.52	Low
CD16+ and TSH	0.575	21.5	0.85	Average
CD16+ and fT4	0.967	36.2	1.44	Average
CD16+ and T3	1.755	65.7	2.61	High
CD16+ and fT3	0.427	16.0	0.64	Low
CD4+ and rT3	0.348	13.0	0.52	Low
CD4+ and Cortisol	0.575	21.5	0.85	Average
CD4+ and TSH	0.617	23.1	0.92	Average
CD4+ and fT4	0.845	31.6	1.26	Average
CD4+ and T3	1.237	46.3	1.84	High
CD4+ and fT3	2.025	75.8	3.01	Critically high
CD3+ and rT3	0.427	16.0	0.64	Low
CD3+ and Cortisol	0.575	21.5	0.85	Average
CD3+ and TSH	1.067	40.0	1.59	Average
CD3+ and fT4	1.295	48.5	1.92	Високий
CD3+ and fT3	2.025	75.8	3.01	Critically high
CD3+ and T3	2.475	92.6	3.68	Critically high



Figu*re 4 – Roc curve for predicting the development of severe acute bronchitis in preschool children*

DISCUSSION

In 2022, Rahat A Memon et al. conducted a study that included a meta-analysis to assess the effectiveness of the SMART-COP (systolic blood pressure, multilobar infiltrates, albumin, respiratory rate, tachycardia, confusion, oxygen, and pH) score in predicting the severity and prognosis of patients with community-acquired pneumonia (CAP). The findings revealed promising accuracy in predicting the need for intensive respiratory or vasopressor support (IRVS), with a pooled sensitivity of 89 % and specificity of 68 %. Additionally, for predicting 30-day mortality, the SMART-COP score demonstrated a pooled sensitivity of 92 % and specificity of 39 %. Overall, the study suggests that SMART-COP is a valuable tool for clinicians in accurately assessing illness severity and identifying patients who require urgent management due to CAP [11].

A team of scientists from South Korea aimed to assess predictors of 28-day mortality in CAP, focusing on serum biomarkers like procalcitonin (PCT) and C-reactive protein (CRP) alongside various clinical risk scales. Among 125 patients, 13 died within 28 days. PCT showed high predictive value with an AUC of 0.83 and sensitivity/specificity of 76.9 % and 90.2 % respectively at a cut-off > 5.6 μg/L. The pneumonia severity scales (PSI, IDSA/ATS, CURB65) exhibited AUCs of 0.86, 0.87, and 0.77 respectively. Combining CRP/PCT with PSI or IDSA/ATS guidelines enhanced predictive performance over individual assessments, indicating PCT as a reliable single predictor and emphasizing the potential for improved risk assessment by incorporating CRP and/or PCT with existing guidelines [15].

Studies by Li Chen and others (2021) focused on understanding the link between clinical indicators and the severity of COVID-19, analyzing retrospective data from 443 hospitalized patients. Patients were categorized into nonsevere and severe groups based on their condition. Significant differences were found in various markers including neutrophil-to-lymphocyte ratio (NLR), CRP, and platelets between the two groups. Multivariate analysis identified NLR and CRP as independent risk factors, while platelets emerged as protective factors for severe COVID-19. The combination of NLR, CRP, and platelet levels showed strong predictive ability for severe cases, with NLR standing out as the most robust predictor among the indicators studied [16].

Other researchers described the potential of soluble urokinase-type plasminogen activator receptor (suPAR) and syndecan-4 as biomarkers in CAP, focusing on severe cases. 103 patients with severe CAP, 149 with non-severe CAP, and 30 healthy individuals were studied. The research found that suPAR levels were notably higher in severe CAP cases, showing high accuracy in diagnosing and predicting severe CAP and mortality, with an AUC of 0.835 and 0.772 respectively, while syndecan-4 levels exhibited a potential in predicting mortality in severe cases but

not as a diagnostic marker. Combining suPAR and syndecan-4 improved the prognostic accuracy, suggesting their potential as independent markers for predicting 30-day survival in severe CAP [17].

A group of scientists from Norway, led by Are Stuwitz Berg, aimed to identify predictors for major medical interventions in pediatric pneumonia: supplemental oxygen, supplemental fluid, respiratory support, intensive care, or treatment for complications during admission. Analyzing a cohort of children with suspected or confirmed pneumonia, hypoxemia and chest retraction scores emerged as significant predictors for needing medical interventions in both groups. However, their effectiveness in ruling out the need for interventions was limited due to low sensitivity, despite high specificity and positive likelihood ratios. CRP and white blood cell count did not correlate with the need for interventions, while multifocal radiographic changes showed an association. The study suggests hypoxemia and chest retractions as potential predictors for severe pneumonia but emphasizes the need for further validation of these findings [18].

CONCLUSIONS / ВИСНОВКИ

The most informative clinical and anamnestic risk factors for severe acute bronchitis in preschool children are chronic upper respiratory tract disease and such a bad habit of parents as smoking. Moreover, if both the mother and the father smoke at the same time, the probability of developing severe acute bronchitis is more pronounced. Cough and auscultatory wheezing with the highest score on the BSS-ped scale have an impact on the development of severe acute bronchitis. In addition, among hormonal parameters, reverse triiodothyronine has a significant effect on the development of severe acute bronchitis. A slightly weaker dependence is observed on T3 and cortisol. Moreover, the results of studies of immunological status indicate that the following indicators contribute to the development of severe acute bronchitis: CD22+, CD4+ and CD8+. We have also found that the combination of changes in such indicators as CD4+ and free triiodothyronine, CD3+ and free triiodothyronine, CD3+ and total triiodothyronine has a pronounced effect on the risk of severe acute bronchitis in preschool children.

Thus, when assessing the condition of preschool children with acute bronchitis, it is advisable to pay attention to some general clinical (the presence of chronic upper respiratory tract disease in the history and parental smoking, severe cough and auscultatory pulmonary rales) and laboratory parameters (concentration of total, free and reverse triiodothyronine, cortisol, levels of CD22+, CD4+ and CD8+ in the serum of patients).

PROSPECTS FOR FUTURE RESEARCH / ПЕРСПЕКТИВИ ПОДАЛЬШИХ ДОСЛІДЖЕНЬ

Exploring the intricate interplay between hormones and immunological parameters in acute bronchitis among pediatric cohorts presents a promising avenue for further research with substantial clinical implications. Investigating the role of hormones, such as cortisol and adrenaline, in modulating the immune response during acute bronchitis could offer insights into the underlying mechanisms of disease progression. Understanding how these hormones influence immune cell function, cytokine profiles, and inflammatory responses in the context of acute bronchitis may elucidate key pathways contributing to disease severity. Moreover, delving into immunological parameters, including inflammatory markers, T cell subsets, and cytokine profiles, can provide a comprehensive understanding of the immune dysregulation associated with acute bronchitis in children. Prospective studies examining how these parameters evolve over the course of the disease and their correlation with clinical outcomes could pave the way for tailored immunomodulatory interventions, potentially mitigating the severity and duration of acute bronchitis episodes in pediatric populations. Additionally, considering the influence of age, sex, and environmental factors on hormone-immune interactions in acute bronchitis would contribute to personalized approaches in managing and treating this respiratory condition in children.

CONFLICT OF INTEREST / КОНФЛІКТ ІНТЕРЕСІВ

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS / ВКЛАД АВТОРІВ

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