MEDICINE PROBLEMS .uz

ISSN 3030-3133

TIBBIYOT FANLARINING DOLZARB MASALALARI

TOPICAL ISSUES OF MEDICAL SCIENCES

№ 3 (4)

2026

САЙТ: https://medicineproblems.uz
ISSN: 3030-3133

MEDICINEPROBLEMS.UZ

TIBBIYOT FANLARINING DOLZARB MASALALARI

№ 3 (4)-2026

TOPICAL ISSUES OF MEDICAL SCIENCES

ТОШКЕНТ-2026

TIBBIYOT FANLARINING DOLZARB MASALALARI elektron jurnali 02.03.2023-yilda 132099-sonli guvohnoma bilan davlat ro‘yxatidan o‘tkazilgan.
Muassis: “SCIENCEPROBLEMS TEAM” mas’uliyati cheklangan jamiyati.

TAHRIRIYAT MANZILI:
Toshkent shahri, Yakkasaroy tumani, Kichik Beshyog‘och ko‘chasi, 70/10-uy. Elektron manzil: scienceproblems.uz@gmail.com

TIBBIYOT FANLARINING DOLZARB MASALALARI
4-jild, 3- son (Aprel, 2026). – 35 bet.

M U N D A R I J A

Article / Original Paper

INTEGRATING CLINICAL REASONING AND PREDICTIVE MODELLING IN ADULT FEBRILE ILLNESS: A CASE REPORT

Sultonova Gulrukh Yunusalievna
PhD, Senior lecturer
Tashkent State Medical University
E-mail: gulruh_yunusaliyevna@mail.ru
Tel: +99890-000-0193
ORCID: 0009-0004-3208-3506

Saloni Sajid Maner
Student, Candidate of General Medicine of Tashkent State Medical University
E-mail: manersaloni07@gmail.com
Tel: +998 917910913

Annotation. This case report describes a 45-year-old male presenting with prolonged fever, weight loss, anemia, and splenomegaly, where multiple differential diagnoses including acute leukemia, visceral leishmaniasis, tuberculosis, sepsis, and malaria were considered. The model output favored a haematological etiology, and subsequent peripheral smear and bone marrow examination confirmed the diagnosis of acute leukemia.

Keywords: predictive model, leukemia, diagnostic reasoning, digital health, medical education.

KATTALARDA ISITMALI KASALLIK HOLATIDA KLINIK FIKRLASH VA PROGNOZLASH MODELLASHTIRISHNI INTEGRATSIYA QILISH: KLINIK HOLAT TAVSIFI

Sultonova Gulrux Yunusalievna
PhD, katta o‘qituvchi
Toshkent davlat tibbiyot universiteti

Saloni Sajid Maner
Davolash fakulteti talabasi
Toshkent davlat tibbiyot universiteti

Annotatsiya. Ushbu klinik holat tavsifida 45 yoshli erkak bemorda uzoq davom etuvchi isitma, vazn yo‘qotish, anemiya va splenomegaliya kuzatilgan bo‘lib, differensial tashxis sifatida o‘tkir leykoz, visseral leyshmanioz, sil, sepsis va bezgak ko‘rib chiqildi. Prognozlash modeli natijalari gematologik etiologiyani afzal deb ko‘rsatdi va keyinchalik periferik qon surtmasi hamda suyak iligi tekshiruvi orqali o‘tkir leykopeniya tashxisi tasdiqlandi.

Kalit so‘zlar: prognozlash modeli, leykoz, diagnostik fikrlash, raqamli tibbiyot, tibbiy ta’lim.

DOI: https://doi.org/10.47390/Med-pro/v4i3y2026/N04

Introduction: The process of differentiating between infectious diseases and hematological malignancies represents one of the most complex and intellectually demanding challenges in clinical medicine, particularly when patients present with nonspecific systemic

symptoms such as prolonged fever, fatigue, weight loss, and laboratory abnormalities including anemia, leukocyte count variations, and thrombocytopenia, which are common to a wide range of pathological conditions. In clinical practice, diseases such as tuberculosis, malaria, sepsis, and visceral leishmaniasis frequently mimic hematological disorders like acute leukemia, especially in their early stages, thereby creating diagnostic ambiguity and increasing the risk of delayed or inappropriate management [1; 2–11-p]. This overlap is further complicated by the fact that many of these conditions share similar inflammatory and biochemical profiles, including elevated erythrocyte sedimentation rate, increased C-reactive protein, and altered protein metabolism, making it difficult to rely on individual laboratory parameters for definitive diagnosis. In many healthcare settings, particularly in developing regions and resource-limited environments, access to advanced diagnostic modalities such as bone marrow biopsy, molecular testing, and imaging studies may be delayed or unavailable, which further amplifies the challenge of timely diagnosis [3]. Under such circumstances, clinicians are often required to depend on clinical judgment and pattern recognition derived from experience, which may vary significantly between practitioners. For medical students and early-career clinicians, this variability poses an additional barrier, as they may struggle to integrate multiple clinical findings into a coherent diagnostic framework. Consequently, there is a growing need for structured approaches that can assist in synthesizing clinical and laboratory data in a systematic and reproducible manner.

The emergence of predictive models and clinical decision support systems (CDSS) has introduced a new dimension to modern medical practice by offering tools that can assist clinicians in analyzing complex datasets and generating evidence-based diagnostic suggestions [2]. These systems range from simple rule-based algorithms to advanced machine learning models, each with its own advantages and limitations. While artificial intelligence-based systems have demonstrated high accuracy in certain domains, they often function as “black boxes,” lacking transparency in their decision-making processes. In contrast, rule-based predictive models, such as the one described in this study, provide a more interpretable framework that aligns closely with traditional clinical reasoning, making them particularly valuable in educational settings and for early-stage clinical decision-making [4, 58-68-p]. The concept underlying the predictive model in this case report is rooted in the principle of pattern recognition, which is a fundamental aspect of clinical expertise. Experienced clinicians often subconsciously integrate multiple data points, including symptoms, signs, and laboratory findings, to arrive at a probable diagnosis. For instance, the combination of pancytopenia and splenomegaly may immediately suggest visceral leishmaniasis, while marked leukocytosis with thrombocytopenia and elevated lactate dehydrogenase levels may point toward a hematological malignancy such as acute leukemia. Similarly, elevated inflammatory markers combined with metabolic abnormalities may indicate sepsis, whereas chronic symptoms with high erythrocyte sedimentation rate may suggest tuberculosis [5; 14-21-p]. By formalizing these associations into a structured model, it becomes possible to replicate expert-level reasoning in a consistent and accessible format. Another important aspect of this approach is its potential role in medical education. Traditional teaching methods often emphasize memorization of disease characteristics without adequately addressing the integration of multiple findings in real clinical scenarios [6; 38-42-p]. As a result, students may find it difficult to apply theoretical knowledge to patient care. A structured predictive model provides an

interactive platform where learners can input clinical data and observe how different parameters influence diagnostic outcomes, thereby enhancing their understanding of disease patterns and improving their analytical skills [7; 330-p]. This aligns with the evolving paradigm of competency-based medical education, which emphasizes critical thinking and problem-solving over rote learning. Furthermore, the integration of such models into digital platforms, including web-based tools and mobile applications, opens new possibilities for their widespread use in clinical practice. With the increasing adoption of electronic health records and digital health technologies, there is a growing opportunity to incorporate decision-support tools directly into clinical workflows, enabling real-time analysis of patient data and facilitating evidence-based decision-making [8; 62-70-p]. This is particularly relevant in high-burden healthcare systems, where clinicians are often required to manage large volumes of patients within limited time frames. Despite these potential benefits, it is important to recognize the limitations of predictive models, particularly those based on rule-based algorithms. Such models rely on predefined associations and may not account for atypical presentations or rare conditions.

Additionally, their accuracy is dependent on the quality and completeness of input data, and they should not be considered a substitute for clinical judgment. Instead, they should be viewed as complementary tools that enhance, rather than replace, the clinician's decision-making process.

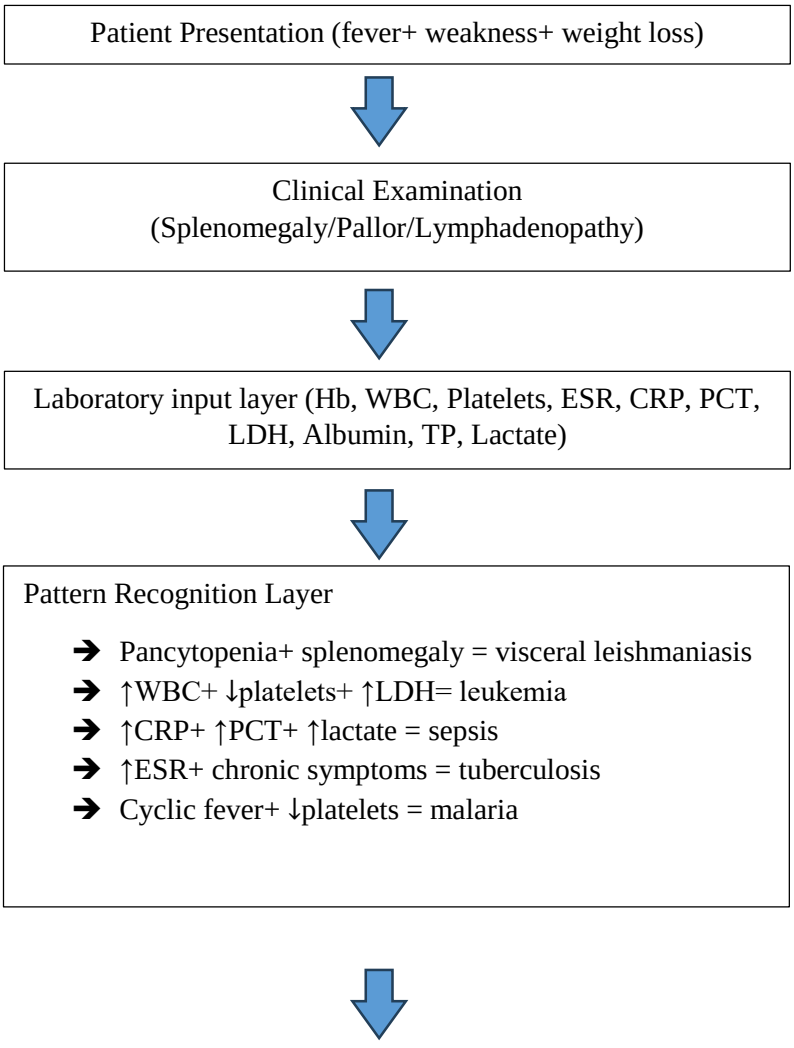
In this context, the present case report aims to demonstrate the practical application of a laboratory-based predictive model in a real-world clinical scenario involving a patient with overlapping features of infectious and hematological diseases. By illustrating how the model integrates clinical and laboratory data to guide diagnostic reasoning and recommend appropriate confirmatory investigations, this study highlights its potential utility in improving diagnostic efficiency, supporting medical education, and contributing to the ongoing evolution of digital healthcare. The findings underscore the importance of combining traditional clinical expertise with innovative technological approaches to address complex diagnostic challenges and improve patient outcomes.

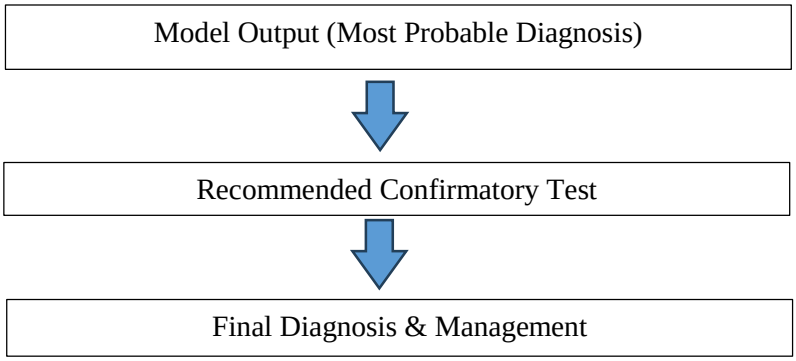
Relevance: The relevance of this study lies in its demonstration of how a simple, rule-based predictive model can bridge the gap between theoretical knowledge and practical clinical decision-making by transforming fragmented clinical data into structured diagnostic insights, thereby improving efficiency and reducing cognitive burden on clinicians, particularly in high-volume healthcare settings; for medical students, such a model serves as an interactive educational tool that reinforces understanding of disease patterns and promotes analytical thinking rather than rote memorization, while for practicing clinicians it offers a rapid and accessible method to prioritize differential diagnoses and guide appropriate investigations, and in the broader context of modern healthcare, this approach aligns with the global shift toward digital medicine and the integration of technology-driven solutions into clinical workflows, making it highly relevant for future advancements in precision medicine and global health systems.

Materials and Methods: A rule-based laboratory-integrated predictive model was developed using routinely available clinical and laboratory parameters, including hemoglobin, white blood cell count, platelet count, erythrocyte sedimentation rate, C-reactive protein, procalcitonin, lactate dehydrogenase, albumin, total protein, and lactate levels, along with

clinical features such as fever pattern, splenomegaly, hepatomegaly, lymphadenopathy, pallor, weight loss, and rapid diagnostic test inputs for malaria and visceral leishmaniasis, and the model operates through a structured algorithmic framework in which each parameter contributes to disease-specific patterns based on established clinical associations, such that combinations like pancytopenia with splenomegaly suggest visceral leishmaniasis, markedly elevated white blood cell count with thrombocytopenia and elevated lactate dehydrogenase suggests leukemia, elevated inflammatory markers with metabolic derangement suggest sepsis, and chronic inflammatory markers with systemic symptoms suggest tuberculosis, and these patterns are synthesized to identify the dominant diagnostic pathway while simultaneously generating recommendations for confirmatory investigations, thereby functioning as an interpretable clinical decision support system that replicates expert-level diagnostic reasoning without relying on complex machine learning algorithms, and the key laboratory parameters with their clinical relevance are summarised in Table 1, while disease-specific pattern associations used in the model are outlined in Table 2.

Algorithmic Framework (Model Logic): The predictive model follows a sequential analytical process beginning with patient symptom input and clinical examination, followed by integration of laboratory parameters, after which a pattern-recognition layer evaluates disease-specific clusters of abnormalities, and based on the dominance of these clusters, the model prioritizes the most likely diagnosis and recommends the most appropriate confirmatory test, thereby ensuring a structured and reproducible diagnostic approach.





Case Presentation and Results: A 45-year-old male presented with a three-week history of fever, generalized weakness, fatigue, and progressive weight loss, with fever initially intermittent but later persistent and associated with night sweats and reduced appetite, and physical examination revealed pallor, splenomegaly, and mild hepatomegaly with subtle lymphadenopathy, while laboratory investigations demonstrated anemia, markedly elevated white blood cell count, thrombocytopenia, elevated erythrocyte sedimentation rate, increased C-reactive protein and procalcitonin levels, elevated lactate dehydrogenase, and reduced albumin levels, as summarised in Table 1, and rapid tests for malaria and visceral leishmaniasis were inconclusive, and when these findings were analyzed using the predictive model, a dominant hematological pattern emerged characterized by leukocytosis, cytopenias, and high cell turnover markers, strongly suggesting acute leukemia over infectious etiologies, based on the disease-pattern associations described in Table 2, and based on this output, peripheral blood smear examination was recommended, followed by bone marrow biopsy, which confirmed the presence of blast cells and established the diagnosis of acute leukemia, thereby demonstrating concordance between the model's prediction and the final clinical diagnosis.

Table 1.

Laboratory Parameters and Interpretation

Parameter	Finding	Interpretation
Hemoglobin	Low	Anemia
WBC	High	Haematological disorders
Platelets	Low	Bone marrow involvement
ESR	High	Inflammatory process
CRP	Elevated	Acute inflammation
Procalcitonin	Elevated	Infection indicator
LDH	High	High cell turnover
Albumin	Low	Chronic illness

Table 2.

Disease Pattern Recognition Matrix

Disease	Key Pattern	Clinical Clues	Confirmatory Test
Leukemia	↑WBC, ↓platelets, ↑LDH	Pallor fatigue	Bone marrow
VL	Pancytopenia	Splenomegaly	rk39/ marrow
Sepsis	↑CRP, ↑PCT	Fever	Blood culture
TB	↑ESR	Weight loss	Sputum

Malaria	↓Platelets	Cyclic fever	Smear

Conclusion: The present case report highlights the practical significance and potential impact of integrating a laboratory-based predictive model into clinical decision-making for patients presenting with complex and overlapping clinical features, particularly in scenarios where infectious diseases and hematological malignancies share similar presentations. The application of this model in a 45-year-old patient with prolonged fever, weight loss, cytopenias, and organomegaly demonstrated its ability to synthesize multiple clinical and laboratory parameters into a structured diagnostic pathway, ultimately guiding the clinician toward a hematological etiology that was subsequently confirmed as acute leukemia through definitive investigations. This alignment between model-based prediction and final diagnosis underscores the value of structured, pattern-based reasoning in enhancing diagnostic accuracy and efficiency. One of the most important contributions of this model lies in its simplicity and interpretability, as it relies on clinically established associations rather than complex computational algorithms, thereby making it accessible to a wide range of users, including medical students, junior doctors, and clinicians working in resource-limited settings. Unlike advanced artificial intelligence systems that often lack transparency, this model provides clear insight into how specific parameters contribute to diagnostic outcomes, allowing users to understand and trust the reasoning process. This feature is particularly valuable in educational contexts, where the emphasis is on developing critical thinking and clinical reasoning skills rather than merely obtaining correct answers. From an educational perspective, the model serves as an effective tool for bridging the gap between theoretical knowledge and practical application. By enabling users to interact with clinical data and observe how different combinations of findings influence diagnostic decisions, it promotes active learning and reinforces the importance of integrated thinking in medicine. This approach aligns with modern trends in medical education, which prioritize competency-based learning and the development of analytical skills necessary for real-world clinical practice. In addition to its educational benefits, the model also holds significant potential for improving clinical workflows, particularly in high-volume healthcare settings where rapid decision-making is essential. By providing a structured framework for evaluating patient data, it can help clinicians prioritize differential diagnoses, reduce unnecessary investigations, and facilitate timely initiation of appropriate management. This is especially relevant in regions with limited access to advanced diagnostic facilities, where efficient use of available resources is critical. However, it is important to acknowledge that the model is not without limitations. As a rule-based system, it depends on predefined clinical associations and may not fully capture the complexity of atypical presentations or rare diseases. Its accuracy is also influenced by the quality of input data, and therefore it should be used as a supportive tool rather than a replacement for clinical judgment. Future developments could focus on integrating machine learning techniques, expanding datasets for validation, and incorporating additional diagnostic modalities such as imaging and molecular testing to enhance its accuracy and adaptability. Looking ahead, the integration of such predictive models into digital platforms represents a promising direction for the future of medicine. With further refinement and validation, these tools could be incorporated into electronic health systems, enabling real-time clinical decision support and contributing to the broader goal of precision medicine. Ultimately, the combination of traditional clinical expertise

with innovative technological solutions has the potential to transform diagnostic processes, improve patient outcomes, and advance the global healthcare landscape.

Адабиётлар/Литература/References

1. Iniguez E, Priyamvada K, Dubey P, Bindroo J, Shahnawaz M, Alam A, Singh S, Kumar A, Kumar G, Kumar P, Pandey S. High seropositivity to rK39 and capture of leishmania-infected sand flies in Bihar and Jharkhand emphasize the need for post-elimination surveillance of visceral leishmaniasis in India. The Journal of Infectious Diseases. 2026 Mar 15;233(3):e80 2-11.
2. Centers for Disease Control and Prevention. Leishmaniasis: Clinical Care and Treatment. Atlanta: CDC; 2024.
3. Available at: https://www.cdc.gov/leishmaniasis/hcp/clinical-care
4. Kovalenko DA, Razakov SA, Ponirovsky EN, Warburg A, Nasyrova RM, Ponomareva VI, Fatullaeva AA, Nasereddin A, Klement E, Alam MZ, Schnur LF. Canine leishmaniosis and its relationship to human visceral leishmaniasis in Eastern Uzbekistan. Parasites & Vectors. 2011 Apr 13;4(1):58-68.
5. MIRZOYEVA MR, GAYBULLAEV FK. Study of clinical features of visceral leishmaniasis in endemic areas of the Republic of Uzbekistan. International Journal of Pharmaceutical Research (09752366). 2020 Jul 1;12(3).14-21.
6. Sethi PP, Bhatia R, Panda PK, Tyagi A, Sarkar N, Singh A, Gaur S. A case report of concomitant infections of cutaneous, mucocutaneous and visceral leishmaniasis. Journal of Vector Borne Diseases. 2026 Jan 1;63(1):1 38-42.
7. Strelkova MV, Ponirovsky EN, Morozov EN, Zhirenkina EN, Razakov SA, Kovalenko DA, Schnur LF, Schönian G. A narrative review of visceral leishmaniasis in Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, the Crimean Peninsula and Southern Russia. Parasites & Vectors. 2015 Jun 16;8(1):330.
8. Usarov GA, Javohir G‘ayrat o‘g N. O‘ZBEKISTON HUDUDIDAGI MOSKITLARNING LEYSHMANIOZ O‘CHOQLARIDAGI TUR-TARKIBI VA EPIDEMIOLOGIK AHAMIYATI. Лучшие интеллектуальные исследования. 2026 Feb 7;62(3):62-70.

САЙТ: https://medicineproblems.uz
ISSN: 3030-3133

MEDICINEPROBLEMS.UZ-

TIBBIYOT FANLARINING DOLZARB MASALALARI

№ 3 (4)-2026

TOPICAL ISSUES OF MEDICAL SCIENCES

TIBBIYOT FANLARINING DOLZARB MASALALARI elektron jurnali 02.03.2023-yilda 132099-sonli guvohnoma bilan davlat ro‘yxatidan o‘tkazilgan.
Muassis: “SCIENCEPROBLEMS TEAM” mas’uliyati cheklangan jamiyati.

TAHRIRIYAT MANZILI:
Toshkent shahri, Yakkasaroy tumani, Kichik Beshyog‘och ko‘chasi, 70/10-uy. Elektron manzil: scienceproblems.uz@gmail.com