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LEISHMANIASIS: A REVIEW OF PATHOGENESIS, DIAGNOSIS, TREATMENT, AND CONTROL STRATEGIES

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Abstract

Leishmaniasis is a tropical parasitic disease caused by Leishmania parasites and transmitted by sandflies. This disease can cause skin lesions, mucosal damage, or affect internal organs, depending on the type of infection. In this review, we summarize the current knowledge about leishmaniasis, including its causes, clinical forms, diagnosis methods, treatment strategies, and prevention measures. Special attention is given to the situation in Central Asia, especially Uzbekistan. Understanding these aspects is important for early detection, effective treatment, and control of the disease.

Keywords

Leishmaniasis; Tropical disease; Diagnosis; Treatment; Epidemiology; Uzbekistan.

Introduction Leishmaniasis is a tropical parasitic disease caused by protozoan parasites of the genus Leishmania and transmitted to humans by the bite of infected sandflies. Despite available treatments, it remains a public health problem in many endemic regions, including Central Asia. The disease can affect the skin, mucous membranes, or internal organs. Early diagnosis and treatment are essential to reduce complications.

Materials and Methods This review is based on analysis of scientific literature published between 2015 and 2025. Articles were obtained from PubMed, Google Scholar, Scopus, and Web of Science using keywords: leishmaniasis, diagnosis, treatment, epidemiology, and disease control. Studies focused on human leishmaniasis and published in English or Russian were included.

Results and Discussion

Pathogenesis of Leishmaniasis Leishmaniasis develops when Leishmania parasites are transmitted to humans through the bite of infected female sandflies. Once inside the body, the parasites are engulfed by immune cells called macrophages. Inside these cells, promastigotes transform into amastigotes, which multiply and damage the cells. The infection spreads locally in the skin or, in visceral forms, to organs such as the liver, spleen, and bone marrow. The severity of the disease depends on the Leishmania species and the host's immune response. For example, L. major and L. tropica typically cause cutaneous lesions, while L. donovani is associated with visceral leishmaniasis. The body responds by activating T-cells and producing inflammatory cytokines, but sometimes the immune response is insufficient, allowing the parasite to survive and multiply. Other factors influencing pathogenesis include malnutrition, co-infections (such as

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HIV), and genetic susceptibility. Understanding how the parasite interacts with the immune system helps in designing effective treatments and vaccines.

Clinical Forms of Leishmaniasis (Kengaytirilgan) Leishmaniasis has three main clinical forms, each with different symptoms and health impacts:

1. Cutaneous leishmaniasis: Causes skin lesions, ulcers, and sores. Often appears on exposed parts of the body like face, arms, and legs. Lesions may heal spontaneously but can leave permanent scars.
2. Mucocutaneous leishmaniasis: Develops from certain species like L. braziliensis. Affects mucous membranes of nose, mouth, and throat. Can lead to disfigurement if untreated, but is less common than cutaneous form.
3. Visceral leishmaniasis: Affects internal organs including liver, spleen, and bone marrow. Symptoms include fever, weight loss, anemia, and enlargement of liver and spleen. Can be fatal if untreated, especially in children and immunocompromised individuals. Other forms like post-kala-azar dermal leishmaniasis may appear after visceral leishmaniasis treatment, characterized by skin nodules and patches.

Diagnostic Approaches Accurate diagnosis of leishmaniasis is critical for effective treatment. Several diagnostic methods are used:

- Microscopic examination: Detects parasites in tissue smears. It is simple and inexpensive but requires trained personnel and may miss low-level infections.
- Serological tests: ELISA or rapid diagnostic tests detect antibodies against Leishmania. They are fast and useful in field settings but can produce false positives due to cross-reactivity.
- Molecular methods (PCR): Detect parasite DNA with high sensitivity and specificity. PCR can identify the species of Leishmania, which helps choose the best treatment. Limitation: requires specialized laboratory equipment.

Culture methods: Growing parasites in artificial media confirms infection but is time-consuming and not widely available. In practice, a combination of methods is often used to improve diagnostic accuracy, for example, microscopy plus PCR. Early diagnosis is especially important in visceral forms, where delayed treatment increases mortality.

Table 1. Diagnostic methods used in leishmaniasis

Diagnostic method	Principle	Advantages	Limitations
Microscopy	Detect parasites	Cheap, simple	Low sensitivity
Serology (ELISA, RDT)	Detect antibodies	Fast	False positives possible
PCR	Detect parasite DNA	High sensitivity	Lab required
Parasite culture	Grow parasite	Confirmatory	Time-consuming

Treatment Strategies Treatment choice depends on the clinical form, parasite species, and patient's health status:

- Pentavalent antimonials (e.g., sodium stibogluconate): First-line treatment for cutaneous and visceral forms. Effective but can cause side effects like liver toxicity and heart rhythm disturbances. Resistance is increasing in some regions.
- Amphotericin B: Used for severe or resistant cases. Highly effective but can have side effects such as kidney toxicity. Liposomal formulations are safer but expensive.
- Miltefosine: Oral drug convenient for outpatient treatment. Avoided in pregnancy due to teratogenic risk.

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- Combination therapy: Combines drugs to increase effectiveness and reduce resistance. Used in complicated or resistant cases. Supportive care, such as treating anemia or infections, is also important. Preventive strategies during treatment include protecting patients from sandfly bites and monitoring for relapses.

Prevention and Control Measures Prevention includes using bed nets, insect repellents, vector control, education, early diagnosis, and timely treatment. Surveillance programs and community interventions reduce spread, especially in endemic regions like Uzbekistan.

Epidemiology in Central Asia and Uzbekistan Leishmaniasis is endemic in Central Asia. Cutaneous form is most common. Factors such as climate, rural living, and limited healthcare contribute to persistence. Children and young adults are most affected. Strengthening surveillance and vector control is important.

Conclusion Leishmaniasis continues to be a public health challenge. Advances in diagnostics and treatment have improved outcomes, but drug resistance and limited access remain. Integrated strategies are essential to reduce disease burden.

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