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Characteristics of Endemic Leprosy Foci Identified in the Aral Sea Region

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Abstract Leprosy remains a chronic infectious disease posing significant medical and social challenges worldwide. This study aims to characterize endemic leprosy foci identified in the Aral Sea region, particularly in the Republic of Karakalpakstan. A retrospective epidemiological analysis was conducted using archival data and regional statistics. The results demonstrate pronounced territorial differences, with the northern zone accounting for the majority of cases. Socio-economic conditions, environmental factors, and household contact play a key role in disease persistence. Despite significant progress in treatment and control, endemic foci remain an important source of new cases.

Keywords Aral Sea region, Leprosy, Epidemiology, Endemic foci

1. Introduction

Leprosy is a chronic infectious disease that continues to pose serious medical and social problems in many countries. According to the World Health Organization, more than 180,000–210,000 new cases are registered annually worldwide [1,2,3,4].

Without timely and effective treatment, approximately 25–30% of patients develop lifelong disabilities. The disease remains a major public health concern in nearly 90 countries, particularly in Southeast Asia, Central and South Africa, and Latin America. About 75–85% of all cases occur in countries such as India, Indonesia, Myanmar, the Philippines, and Brazil [5,6].

The causative agents, *Mycobacterium leprae* and *Mycobacterium lepromatosis*, primarily affect the skin and peripheral nervous system. Despite differences at the genetic level, both pathogens are intracellular parasites leading to severe disability if untreated [7,8].

The aim of this study is to investigate and characterize endemic leprosy foci in the Aral Sea region, particularly in the Republic of Karakalpakstan.

2. Methods

A retrospective epidemiological study was conducted based on archival materials, historical records, and published scientific literature. The analysis focused on the territorial distribution of leprosy, endemic foci, and epidemiological indicators.

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The region was divided into two zones:

- Northern (high endemicity)
- Southern (low endemicity)

Comparative analysis was performed to identify differences in disease prevalence, transmission, and contributing factors.

3. Results

There is no exact historical evidence regarding the initial emergence of leprosy in Karakalpakstan. However, during the 1920s–1930s, the disease was highly prevalent. In northern areas near the Aral Sea, incidence exceeded 30.4 per 100,000 population and accounted for 20–25% of all cases in the former Soviet Union.

In response, the first leprosarium was established in 1933. At that time, isolation of patients was the only effective control measure.

Two epidemiological zones were identified:

- **Northern zone:** Muynak, Takhtakupir, Chimbay, Karauzyak, Shumanay, Bozatov, Nukus, Takhiatash
- **Southern zone:** Amudarya, Turtkul, Ellikkala, Beruni

The northern zone accounted for 95.5% of cases, while the southern zone accounted for 4.5–5.5%. A total of more than 3,500–4,000 cases were registered.

After the introduction of sulfone drugs in 1953, treatment became possible, although recovery required 5–20 years.

By 1960:

- Republic incidence: 30.4 per 100,000
- Northern region: 43.7 per 100,000
- Muynak district: up to 185.6 per 100,000

That year, 161 new cases were identified, with over one-third in Muynak.

Disease spread was associated with:

- Poor socio-economic conditions
- Dietary habits (salted/smoked fish)
- Harsh working conditions
- Genetic predisposition

Household transmission was significant:

- 33.8%–42.5% of cases linked to close contact
- 80–90% of new cases linked to old endemic foci

Child infection rates declined:

- 1961–1980: 43.0%
- 1981–1985: 17.5%
- 1986–1999: 8.0%

Sources of infection:

- Parents: 35.0–44.2%
- Siblings: 18.2%

Relapse rates:

- Multibacillary: up to 44.5%
- Paucibacillary: 1.6–7.4%

Relapses decreased significantly over time.

4. Discussion

Leprosy in Karakalpakstan demonstrated a strong endemic pattern, especially in northern regions near the Aral Sea. The persistence of the disease is closely linked to socio-economic, environmental, and behavioral factors.

Old endemic foci remain the main source of new cases even when overall incidence declines. Therefore, continuous epidemiological monitoring is essential.

The introduction of multidrug therapy significantly reduced disease prevalence. However, long-term complications remain severe, with 60–80% of patients developing disabilities and up to one-third experiencing blindness.

Preventive strategies should include:

- Strengthening epidemiological surveillance
- Early diagnosis and treatment
- Improved living conditions
- Implementation of ophthalmological care to prevent vision loss

5. Conclusions

Leprosy in the Aral Sea region remains an important public health issue due to persistent endemic foci. Although significant progress has been made in treatment and control, long-term complications and residual transmission continue to pose challenges. Comprehensive epidemiological monitoring and targeted interventions are necessary to eliminate the disease and prevent disability.

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