

Descriptive Epidemiological Profile of Cutaneous Leishmaniasis: A Hospital-Based Cross-Sectional Study in a Border District of Khyber Pakhtunkhwa, Pakistan

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Abstract

Background Cutaneous Leishmaniasis is a neglected tropical disease endemic in Pakistan, particularly along the Afghanistan border. District Dir Lower in Khyber Pakhtunkhwa faces significant disease burden due to cross-border migration, refugee settlements, and suitable sandfly vector ecology.

Objective This study aimed to describe the epidemiological and clinical characteristics of Cutaneous Leishmaniasis (CL) among suspected patients presenting to healthcare facilities in District Dir Lower, Khyber Pakhtunkhwa, Pakistan.

Methods Three hundred (300) patients with suspected CL lesions were enrolled in the study. Confirmed cases were identified via microscopic examination of Giemsa-stained slit-skin smears for *Leishmania* amastigotes. A structured questionnaire was administered to collect data. Data were analyzed using descriptive statistics (frequencies, percentages). Associations were explored using the Chi-square test ($P < .05$).

Results Infection frequency was significantly higher among Afghan refugees (57.37%, 35/61) compared to Pakistani locals (42.62%, 26/61) ($P < .001$). The highest proportion of cases was in the 1-10 years age group (32.78%, 20/61). Samarbagh subdivision accounted for the highest proportion (22.95%, 14/61). A seasonal peak was observed in July (36.06%, 22/61), with a gradual decline thereafter. Wet lesions (59.01%, 36/61) and single lesions (63.93%, 39/61) were more frequent. Shepherds constituted the highest occupational group (34.42%, 21/61).

Conclusion CL in District Dir Lower exhibits a heterogeneous descriptive profile influenced by age, ethnicity, occupation, season, and geography. Findings represent hospital-based frequency and not population prevalence. Integrated control strategies targeting high-risk groups are warranted.

Keywords Epidemiology; Cutaneous leishmaniasis; Infection; Prevalence; Determinants.

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Introduction

Leishmaniasis is a complex of neglected tropical diseases caused by obligate intracellular protozoan parasites of the genus *Leishmania*, transmitted by female phlebotomine sandflies.¹ Over 20 *Leishmania* species infect humans, causing

manifestations ranging from cutaneous ulcers to fatal visceral disease.^{2,3} The parasite life cycle involves

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inoculation into the dermis and intracellular multiplication within macrophages, enabling immune evasion and diverse clinical outcomes.^{4,5}

Cutaneous Leishmaniasis (CL) is the most common form, with an estimated 600,000 to 1 million new cases annually across 90 countries.⁶ Epidemiology varies by transmission cycle: zoonotic CL (ZCL) primarily involves *L. major* with rodent reservoirs, while anthroponotic CL (ACL) involves *L. tropica* with human reservoirs.⁶ In the Old World, including Pakistan, *Phlebotomus* sandflies are the vectors.⁷

Pakistan, particularly Khyber Pakhtunkhwa (KP) province, has progressed from sporadic CL reports to endemicity with epidemic episodes.⁸ This shift is attributed to socio-ecological changes, including deforestation, climate change, and large population movements.^{9,10} The influx of refugees from hyperendemic regions of Afghanistan into previously low-endemic areas of Pakistan has been a critical factor in CL establishment and persistence.¹¹

District Dir Lower, located along the Pakistan-Afghanistan border in KP, represents an epidemiological interface with porous borders, refugee settlements, and suitable sandfly ecology.¹²

Despite recognized CL impact in this district, comprehensive epidemiological data remain limited; prior studies have been clinically based, potentially underestimating disease burden.^{13,14} Therefore, this study aimed to describe the contemporary epidemiological and clinical profile of CL in Dir Lower using a laboratory-confirmed, hospital-based approach.

Methods

A hospital-based cross-sectional study was conducted from July to November 2019 in District Dir Lower, Malakand Division, Khyber Pakhtunkhwa, Pakistan (**Figure 1**). The district comprises seven tehsils: Timergara, Balambat, Munda, Samar Bagh, Adenzai, Khal, and Maidan. Data were collected at the District Headquarters (DHQ) Hospital Timergara, the primary healthcare facility for both local populations and Afghan refugees.

Participants were suspected CL patients presenting to DHQ Hospital Timergara and other health centers during the study period. Inclusion criteria were: age 1-50 years, either gender, and presence of suspicious skin lesions (e.g., ulcers, nodules, papules).

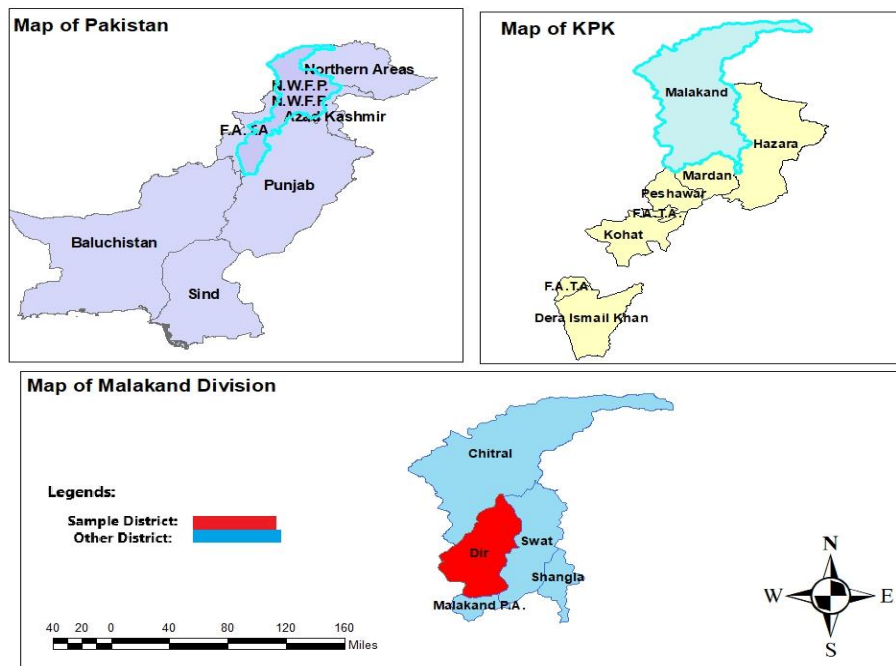


Figure 1 Study area map showing sampling district as red highlighted in Malakand division.

Exclusion criteria were: patients already on anti-leishmanial treatment and those refusing consent. A consecutive sampling method was used.

Sample size (n=300) was calculated using the single population proportion formula: $n = Z^2 * p(1-p) / d^2$, assuming an expected prevalence of 20% from regional studies,¹⁵ 95% confidence interval (Z=1.96), and margin of error of 5%. A 10% non-response rate was added, yielding a target of 300.

A structured, pretested questionnaire was administered through face-to-face interviews to collect:

- Sociodemographic variables: age, gender, ethnicity (Afghan refugee or Pakistani local), area of residence (tehsil), profession.
- Clinical variables: lesion number (single, two, >2), lesion site (face, arm, nose, legs, feet), lesion type (wet/ moist: exudative/ulcerated; dry: nodular/crusted).
- Seasonality: month of presentation.
- All suspected patients underwent slit-skin smear from the active margin of the lesion using a sterile lancet. Smears were air-dried, fixed in absolute methanol, and transported to the laboratory.

Fixed smears were stained with 10% Giemsa solution (pH 7.2) for 45-60 minutes. Microscopic examination was performed under oil immersion (1000x). Presence of intracellular amastigotes (Leishman-Donovan bodies) within macrophages was diagnostic for CL. All slides were read independently by two experienced microscopists; discrepancies were resolved by a third reader.

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics were calculated: frequencies and percentages for categorical variables (age groups, gender, ethnicity, area, profession, lesion characteristics, months). The Chi-square test for independence was used to explore associations

between CL positivity and categorical variables. A *P*-value <.05 was considered statistically significant.

Ethical approval was obtained from the Institutional Review Board of Department of Zoology, Islamia College University Peshawar (2017/ICP-6230 Dated February 21, 2019). Written informed consent was obtained from all adult participants and from parents/ guardians of children.

Result

A total of 300 confirmed patients were enrolled. Of these, 61 (20.3%) were microscopically confirmed positive for cutaneous leishmaniasis (CL). Among the 61 confirmed cases, 35 (57.4%) were Afghan refugees and 26 (42.6%) were Pakistani locals.

The overall sample comprised 160 males (53.3% of total patients) and 140 females (46.7% of total patients). Among confirmed CL cases, the frequency was 21.3% (34/160) in males and 19.3% (27/140) in females; this difference was not statistically significant (*P* > .05).

In terms of ethnic distribution, the study sample included an equal number of Afghan refugees and Pakistani locals, with 150 individuals (50%) from each group. The Afghan refugees showed a significantly higher CL frequency (57.4%, 35/61) compared to Pakistani locals (42.6%, 26/61) (*P*<.001). The highest proportion of cases was in the 1–10 years age group (32.8%, 20/61), followed by the 11–20 years group (26.2%, 16/61). Frequency declined with increasing age (**Table 1**).

Among subdivisions, Samarbagh accounted for the highest proportion of CL cases (23%, 14/61), followed by Munda (19.7%, 12/61) and Timergara (18.1%, 11/61). A significant seasonal pattern was observed (*P*<.001): July had the highest frequency (36.1%, 22/61), with a progressive decline through November (9.8%, 6/61) (**Table 1**).

Single lesions were most common (63.9%, 39/61). Wet lesions (59 %, 36/61) were more frequent than dry lesions (41%, 25/61). The face was the most common lesion site (29.5%, 18/61), followed by arms (23%, 14/61). Among occupational groups, shepherds comprised the highest proportion (34.4%, 21/61), followed by labourers (24.6%, 15/61) (**Table 1**).

Discussion

This hospital-based cross-sectional study provides a

Table 1 Characteristics of microscopically confirmed CL cases (n=61).

Characteristic	Category	Positive Cases (n)	Percent (%)	P-value
Ethnicity	Afghan refugees	35	57.4	<.001
	Pakistani locals	26	42.6	
Age group (years)	1–10	20	32.8	<.001
	11–20	16	26.2	
	21–30	13	21.3	
	31–40	7	11.5	
	41–50	5	8.2	
Sub-division	Samarbagh	14	22.9	<.001
	Munda	12	19.7	
	Timergara	11	18.1	
	Maidan	9	14.7	
	Khal	8	13.1	
	Adenzai	7	11.5	
Month	July	22	36.1	<.001
	August	13	21.3	
	September	12	19.7	
	October	8	13.1	
	November	6	9.8	
Lesion type	Wet	36	59	<.001
	Dry	25	40.9	
Lesion site	Face	18	29.5	<.001
	Arm	14	22.9	
	Nose	11	18	
	Legs	10	16.3	
	Feet	8	13.1	
Number of lesions	1	39	63.9	<.001
	2	14	22.9	
	>2	8	13.1	
Profession	Shepherd	21	34.4	<.001
	Labourer	15	24.6	
	Merchant	13	21.3	
	Teacher	7	11.5	
	Doctor	5	8.2	

descriptive epidemiological profile of CL among suspected patients in District Dir Lower, reporting an overall frequency of 20.3% (61/300). This finding is consistent with previous reports from neighboring regions^{8,16} but lower than the 51% reported by an earlier study in a similar setting.¹⁷ This discrepancy may be attributable to differences in study methodology: the present study used laboratory confirmation (microscopy) rather than clinical diagnosis alone, which can overestimate prevalence by including other dermatological conditions.¹⁸

The significantly higher frequency of CL among Afghan refugees (57.4%) compared to Pakistani locals (42.6%) supports the hypothesis that cross-border population movement from hyperendemic Afghanistan is a major driver of CL epidemiology in Pakistan.¹⁹ This contrasts with earlier studies in refugee camps that reported similar rates between refugees and hosts,¹³ possibly reflecting ongoing environmental and behavioral exposures. The high frequency in border subdivisions such as Samarbagh further supports the role of cross-border pathogen introduction.²⁰

The age distribution showed highest frequency in children aged 1-10 years (32.8%), which is concerning and may reflect immunological naivety and outdoor play activities.²¹ The declining frequency with age could indicate acquired immunity following subclinical or prior infections.²² The slightly higher frequency in males (21.3 % vs. 19.3%) may be explained by greater outdoor occupational exposure.²³

The seasonal peak in July (36.1%) aligns with the ecology of *Phlebotomus* sandflies, whose reproductive activity and biting rates peak during hot, humid summer months.⁷ This finding provides evidence for pre-emptive vector control timing. The predominance of CL among shepherds (34.4%) suggests a possible zoonotic component, warranting further molecular and entomological investigation to identify reservoir hosts.¹⁷

Clinically, the higher frequency of wet lesions (59%)

compared to dry lesions may reflect the infecting *Leishmania* species or bacterial co-infection, requiring species-specific molecular diagnosis in future studies.¹⁸ The frequent involvement of the face (29.5%) carries psychosocial implications, amplifying disease burden beyond physical morbidity.²³

Conclusion

This study reveals a multifaceted descriptive epidemiological profile of CL in District Dir Lower, characterized by higher frequency among Afghan refugees, children aged 1–10 years, shepherds, residents of border subdivisions, and cases presenting in July. These findings highlight the need for integrated control strategies including cross-border collaboration, targeted vector control in high-risk areas, and health education among vulnerable groups. Future research should incorporate molecular characterization and community-based prevalence surveys.

Limitations This study is hospital-based, and findings represent frequency among patients seeking care, not true population prevalence. The cross-sectional design limits causal inference. Seasonality data rely on month of presentation, not transmission timing. No molecular typing was performed to identify *Leishmania* species.

Declaration of patient consent Authors certify that they have obtained all appropriate patient consent.

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Author's contribution

WU: Substantial contribution to study design, analysis and interpretation data, manuscript writing,

MI: Substantial contribution to acquisition of data, manuscript writing.

RU: Substantial contribution to data analysis and interpretation of data, manuscript writing.

AN: Substantial contribution to data analysis and interpretation of data, critical review of the manuscript.

RR: Contribution to concept, study design, critical review of the manuscript.

Every author has given final approval of the manuscript version to be published and agreed to be accountable for all aspects of the work.

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