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Prevalence of Cutaneous Leishmaniasis among the Local Population of South Waziristan District, Khyber Pakhtunkhwa, Pakistan

Original Article

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Abstract

In Pakistan, particularly in South Waziristan, cutaneous leishmaniasis is a severe public health concern that is an emergent tropical disease. This investigation aimed to evaluate the prevalence of CL in this area. The research was carried out between October 2024 and December 2024 at the District Headquarters Hospital (DQH) located in South Waziristan, Wana. Microscopic slides stained with Giemsa were prepared from needle aspirates, and data analysis was performed using SPSS software. Microscopic testing revealed that 440 (55%) of the 800 clinically suspected patients were positive. Among the 440 patients, 242 (55%) were males and 198 (45%) were females. The abrasions began on the face and spread to the upper and lower extremities. The age category of 5–10 years was the most significant, comprising 202 individuals, or 45% of the total population. One lesion impacted 81.32% of the patients, whereas 13.2% exhibited two lesions and 5.6% had three lesions. A significant frequency of CL was seen from April to August, whereas the lowest incidence was recorded from November to December. The research finds that participants have limited understanding of etiology, risk factors, and treatment options related to CL. There is an immediate and pressing need for an increase in awareness and education throughout the population to minimize the burden of the disease and its impact on the economy. An increase in education and awareness is also necessary.

Keywords: Leishmania Tropica, Cutaneous Leishmaniasis, Etiology, South Waziristan, Pakistan.

Introduction

Leishmaniasis is an inflammatory chronic illness caused by the obligatory intracellular protozoan Leishmania, a hemoflagellate from the genus Leishmania. Leishmania parasites are distributed across Asia, Europe, and Africa, whereas Viannia is present in tropical and subtropical regions of America. This disease is endemic to 88 countries, with twelve million cases reported globally by 1991. The incidence has increased by 1.5 to 2.0 million cases annually, resulting in approximately 100,000 deaths each year.

These species can induce Leishmaniasis in many vertebrates, including Carnivora (felids and canids), Rodentia (murids and gerbils), and Primates (humans and simians). Leishmaniasis has also been identified in invertebrates, including phlebotomine sand flies and ticks. Sand flies of the genera Phlebotomus and Lutzomyia are the principal vectors for the transmission of these parasites from host to host (Rostamian *et al*., 2021).

Cutaneous leishmaniasis affects all age demographics; however, children represent a particularly vulnerable population impacted by this debilitating illness, posing a significant public health issue. The increased prevalence of cutaneous leishmaniasis in young children may result from insufficient immunity, socioeconomic deprivation, peri-domestic anthroponotic transmission, and inadequate awareness and access to fundamental health services. Disease may profoundly affect a child's physical, emotional, and social well-being, as well as their overall health development. Children afflicted with cutaneous leishmaniasis are typically marginalized from social activities by the general populace, especially young girls (Lu *et al*., 2024).

In Pakistan, there has been a notable increase in cases of cutaneous leishmaniasis, particularly in the northwestern region of Khyber Pakhtunkhwa. This condition is prevalent in areas adjacent to the Pak-Afghan border, especially within the merged tribal districts of Khyber Pakhtunkhwa. Moreover, Khyber Pakhtunkhwa possesses the most extensive northwest boundary with Afghanistan, a region notably affected by cutaneous leishmaniasis. The Khyber Pass serves as a significant conduit in the area, facilitating trade and the substantial influx of Afghan refugees, who have established themselves in various refugee camps throughout Khyber Pakhtunkhwa. The disease has transitioned from endemic to non-endemic areas, posing substantial challenges to both national and international health authorities (Khan *et al*., 2022).

Leishmaniasis, including cutaneous and visceral types, presents a significant health risk in several climatic regions of Pakistan and other countries such as Afghanistan, India, Brazil, Latin America, Iran, Iraq, Peru, Saudi Arabia, and Syria. Cutaneous Leishmaniasis is predominantly restricted to the provinces of Khyber Pakhtunkhwa, Azad Jammu and Kashmir, Balochistan, and Punjab, whereas Visceral Leishmaniasis is endemic and especially widespread in Gilgit Baltistan and Azad Jammu and Kashmir (Ilahi & Shahid, 2024). As part of our ongoing research program on Leishmaniasis, we have recently reported the prevalence of Leishmaniasis in South Waziristan.

The region along the Pakistan-Afghanistan border experiences significant levels of immigration and emigration between the two nations. Therefore, the local community needs to gain a comprehensive understanding of the severity of the situation and the methods to manage the Leishmania parasite. This investigation represents a segment of the broader endeavor to ascertain the prevalence of L. tropica among schoolboys in South Waziristan, employing both conventional and molecular methodologies.

The objective of this study was to assess the knowledge, attitudes, and practices (KAP) of the residents of the South Waziristan Agency (KPK province) in Pakistan concerning CL. At present, there is a lack of information from this area that is highly endemic to CL. This data will fill the existing gap and support health authorities in formulating effective control strategies within the CL endemic region.

Figure 1
Houses are constructed from mud and have integrated living spaces in South Waziristan.

Literature Review

Cutaneous leishmaniasis represents a significant public health issue in Pakistan. CL is prevalent throughout Pakistan; however, most cases are consistently reported in the KP province, which borders Afghanistan, particularly in districts with a significant refugee population. Worldwide, CL affects roughly 1.2 billion people, with 5–20 million new cases reported each year, according to the World Health Organization (WHO). Leishmaniasis is presently endemic in 88 countries across five continents, affecting a total of 350 million individuals at risk. Leishmaniasis, in its singular or all forms, has been identified in the specified nations (Afghan *et al.*, 2011).

The principal endemic regions of Khyber Pakhtunkhwa encompass the southern area, notably Waziristan, along with various districts such as Mardan, Swabi, Nowshera, Dir, Buner, and Bajaur. This study addresses the limited data on the prevalence of cutaneous leishmaniasis (CL) and its treatment efficacy in Pakistan, focusing on the current epidemiology, diagnosis, and treatment of this neglected disease in the Khyber Pakhtunkhwa province (Iqbal *et al.*,

2022). Initially identified in Pakistan in 1960, it was previously confined to the northern hilly region but has now proliferated to nearly include the whole nation. Pakistan was home to an estimated 400 thousand cases of cutaneous leishmaniasis in 2016, accounting for around 10% of all cases worldwide (Khan *et al*., 2021).

Pakistan is characterized by a diverse geography that includes both highland and lowland regions. Figure 1 illustrates the present distribution of Leishmania species in Pakistan. Baltistan, situated in the northern regions of Pakistan, lies to the east of Gilgit and north of the Himalayas, within the majestic Karakoram Mountain range. This area boasts an impressive average altitude of 20,000 feet, with certain sections perpetually adorned in snow. A multitude of valleys can be found within the Indus River valley, positioned at altitudes varying from 6000 to 10,000 feet above sea level.

The central and southern regions of Pakistan are defined by their flat topography, where the climate is distinctly oppressive. Rab and Evans (1995) recorded the occurrence of L. (L.) infantum in the Himalayan region; however, recent research suggests that the species of Leishmania found in the northern regions, including NWFP and neighboring Afghanistan, is L. (L.) tropica. Multiple localities in the Punjab province have documented a substantial prevalence of CL (Raja *et al*., 1998).

There have been documented instances of elevated rates of both cutaneous and visceral leishmaniasis in the province of Baluchistan, which is distinguished by its elevated terrain, as well as in the adjacent regions of Afghanistan and Iran. The identified strains were categorized as L. (L.) tropica using an electrophoresis technique (Ayub et al., 2001). Additionally, research conducted in the southern region of Baluchistan (Bhutto et al., 2003) and the neighboring areas of Iran revealed a significant occurrence of CL linked to L. (L.) major (Bhutto *et al*., 2009).

Figure 2

Distribution of Leishmania species in Pakistan, including those previously reported in Balochistan, Punjab, North-West Frontier Province, and Kashmir. The shaded region around Larkana city in Sindh province is the research area for Leishmania major and Leishmania tropicana.

Materials and Methods

Field of Study

From October 2024 to December 2024, this observational research was performed in a leishmaniasis referral facility situated at the District Headquarters (DHQ) Hospital Wana in South Waziristan. The district of South Waziristan encompasses an area of 11,585 square kilometers (4,473 square miles) and is home to a population of 888,675 individuals.

The three subdivisions comprise eight Tehsils: Ladha, Makin, Sararogha, Sarwakai, Tiarza, Wanna, Barmal, and Toi Khula. Waziristan is in the southwestern part of Khyber Pakhtunkhwa. It is situated between two rivers, with the Tochi River flanking the north and the Gomal River bordering the south (Khan *et al*., 2021).

Evaluation of the Patient and Smear Analysis

Eight hundred individuals clinically suspected of cutaneous leishmaniasis were assessed at the District Headquarters Hospital (DHQ) Laboratory in South Waziristan, KPK. Following the acquisition of both verbal and written informed consent from the patients, samples were gathered, and images were captured.

Samples of lesions from individuals diagnosed with cutaneous leishmaniasis were obtained using the needle aspiration technique. The smear slides were fixed with alcohol and subsequently stained with Giemsa stain to enhance the visibility of the parasites during examination.

The stained slides underwent meticulous examination using the oil immersion objective to identify the Leishmania parasite and validate the presence of amastigotes associated with CL. The slides were put in a slide case and inspected using a microscope. The study omitted participants who had received antileishmanial medication in the weeks prior and those who had other dermatological disorders.

Analysis of Data

Analysis of statistical data and disease characteristics was conducted using SPSS version 21.

Results and Findings

Lesion samples from 800 patients with clinically suspected cutaneous leishmaniasis underwent examination utilizing the Giemsa stain. Among 800 patients, 440 (55%) tested positive through microscopic examination.

Table 1 presents the sociodemographic characteristics of patients diagnosed with cutaneous leishmaniasis. Of the 440 patients in the sample, 242 (55%) were men and 198 (45%) were women.

The patients were categorized into seven distinct age groups. A total of 202 patients (45%) were identified within the 5–10-year age range, while 114 patients (25%) were younger than 5 years (Table 1).

Table 1
Outlines the demographic traits of those who have cutaneous leishmaniasis (n = 440).

Factors		N (%)
Sex	**Male**	238 (5%)
	Female	198 (45%)
Age, years	<5	114(25%)
	5-10	202(45%)
	11-15	31(7%)
	16-20	22(5.2%)
	21-25	15(3.4%)
	25-30	12(2.9%)
	30+	44(10%)
Level of education (n = 129)	Secondary school	107 (83%)
	College	14 (10.8%)
	University	8 (6.2%)
	Illiterate	311 (70.6%)
Locality Local	Locals	436 (99%)
	Nonlocal	4 (01%)
Profession (n = 440)	Farmer	141(32%)
	Labor	110(25%)
	Government servant	65(14.7%)
	Jobless	124(28.1%)
House type	Cement	176(40%)
	Mud	264 (60%)
Holes in the home	Present	308 (70%)
	Absent	132 (30%)
Habitat	Urban	50 (11.3%)
	Rural	390 (88.7%)

Concerning education, a significant portion of the population was illiterate, totaling 311 individuals, which represents 70.6%. Furthermore, 390 (88%) of the patients originated from rural regions. Most patients, 264 (60%), lived in mud huts. Many patients, 308 (70%), resided in dwellings with holes. A total of 141 patients (32%) were identified as farmers, 124 patients (28%) as unemployed, and 110 patients (25%) as laborers (refer to Table 1).

An investigation of the prevalence of cutaneous leishmaniasis was also carried out in South Waziristan, encompassing several different regions and subdivisions. The highest prevalence was recorded in Wana at 41.1%, with Sarwakai following at 28.8%, and Ladha at 13.6% (Table 2). Giemsa-stained smears obtained from skin scrapings and aspirates exhibited amastigotes that were characterized by their rounded or oval shapes, as well as prominent nuclei and kinetoplasts.

The Lesions of cutaneous leishmaniasis primarily manifest on areas of the body that are exposed, such as the face and both the upper and lower limbs (Table 3).

Table 2
Regions impacted by cutaneous leishmaniasis (n = 440) as shown

Area	N = (%)
Wanna	181 (141.1%)
Sarwakai	127 (28.8%)
Ladha	40 (9%)
Sararogha	34(7.7%)
Tiarza	24(5.4%)
Makin	15(3.4%)
Barmal	12(2.7%)
Toi Khula	11(2.5%)

Table 3
Distribution and quantity of lesions in cutaneous leishmaniasis (n = 440).

Lesion	Site	N (%)
Single	Head	2 (0.04%)
	Face	216 (50%)
	Ears	11 (2.5%)
	Neck	4 (0.9%)
	Trunk	3 (0.68%)
	Hands	65 (14.7%)
	Legs	55 (12.5%)
Double	Shoulders	3 (0.7%)
	Face, hands	18 (4.0%)
	Face, legs	17 (3.8%)
	Hands, legs	21 (4.7%)
Triple	Ears, hands, legs	12 (2.7%)
	Face, hands, legs	13 2.9%)

Discussion

Cutaneous leishmaniasis is an emerging tropical disease that poses a significant public health challenge in Pakistan, especially in Khyber Pakhtunkhwa and tribal areas. The extensive data on disease incidence and distribution, coupled with confirmed cases by microscopy, complicates the assessment of endemicity trends—whether they are increasing, decreasing, or stable. Assessing the incidence of cutaneous leishmaniasis infection in Pakistan presents significant obstacles. Pakistan is home to both zoonotic cutaneous leishmaniasis (zoonotic cutaneous leishmaniasis [ZCL] and anthropologic cutaneous leishmaniasis [ACL]) and visceral leishmaniasis (VL), with the cutaneous variant being somewhat more prevalent. This study aimed to geographically delineate various manifestations of leishmaniasis in Pakistan (Pires, Wright, Kaye, da Conceição, & Churchill, 2019).

The risk of contracting leishmaniasis was assessed in a variety of regions throughout the nation. The most recent discoveries indicate that cutaneous leishmaniasis is prevalent in the northern and western regions of Pakistan. Leishmania major, the principal causative agent of ZCL, is prevalent in arid and semi-arid regions, particularly at altitudes between 45 and 2,837 m, with the highest incidence observed at lower elevations. Instances of Leishmania

tropica associated with ACL were documented at altitudes between 551 and 2,837 m, predominantly at higher elevations.

Visceral leishmaniasis (VL), induced by Leishmania infantum, has been intermittently detected in northern regions at altitudes ranging from 1,432 to 2,873 meters. In hilly regions, agricultural settlements, and the presence of dogs, the most often identified risk factors for VL were noted. Conversely, inadequate preventative measures, movement patterns, the presence of domesticated animals, cow excrement, residing in mud dwellings, and outside sleeping were recognized as the primary risk factors linked to cutaneous leishmaniasis (CL). This research can assist health professionals and medical entomologists in implementing focused and economical surveillance and control measures for leishmaniasis in Pakistan (Khan, Khan, & Wahid, 2021).

Conclusion

This research presents an in-depth analysis of the prevalence of cutaneous leishmaniasis in South Waziristan of Pakistan, along with a detailed examination of the demographic characteristics of those impacted. Conclusively, the highest incidence of leishmania infection was observed during the brief study period, and most cases demonstrated a positive response to treatment. Furthermore, because of political issues and life-threatening circumstances in the Pak-Afghan border and FATA regions of KP, significant research efforts have yet to be undertaken by both national and international scholars.

Limitations and Future Research Directions

There were two shortcomings to this investigation. First, the lack of resources and financing for the project was a serious limitation that held it back greatly. Consequently, it is advisable for further research to utilize improved molecular tests for species identification in this domain. Secondly, thorough research into the role of sand-fly vectors was impeded by the researchers' restricted access to the study region due to security concerns. The existing gaps in understanding CL and its transmission within the research community underscore the critical necessity for the implementation of health education and awareness initiatives aimed at mitigating the risk and burden in this highly endemic region soon. Future researchers can go beyond these limits to generalize the results.

Declarations

Ethical Approval and Consent to Participate: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. Informed consent was not required, as secondary data available on websites was obtained for analysis. All procedures performed in this study were by the ethical standards of the Helsinki Declaration.

Consent for Publication: Not Applicable

Availability of Data and Materials: Data for this study will be made available upon request from the corresponding author.

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