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Original Research Article

The Persistence of Hansen's Disease: A Five-Year Profile of High Bacillary Indices and Pediatric Cases from East Vidarbha region

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Abstract

Background: Leprosy, or Hansen's disease, remains a chronic infectious challenge caused by *Mycobacterium leprae*, primarily affecting the skin and peripheral nerves. Despite national elimination efforts, leprosy transmission persists in marginalized communities in India. This study aimed to determine the pattern, prevalence, and trends of slit-skin smear-positive leprosy cases in East Vidarbha region to assess post-elimination challenges.

Methods: A retrospective analysis was conducted at a tertiary care institution in Nagpur over a five-year period from January 2020 to February 2025. Clinical and bacteriological data from 239 slit-skin smear-positive cases, identified from 502 suspected individuals, were evaluated.

Results: Males were predominantly affected, making up 64.9% of the cases with a male-to-female ratio of 1.8 to 1. The highest incidence occurred among individuals aged 41 to 50 years, representing 23.4% of the total. Additionally, children aged ≤ 10 years accounted for 5.0% of the cohort, which points to active community transmission. Multibacillary leprosy was responsible for 71.5% of the cases. Furthermore, 51.9% of the patients exhibited a high Bacillary Index of ≥ 5, while the highly infectious borderline lepromatous and lepromatous types made up 56.5% of all clinical presentations. The study also highlighted a significant surge in cases during 2023, representing 36.8% of the total, alongside a relapse or re-treatment rate of 20.9%.

Conclusion: The high burden of multibacillary disease and pediatric cases confirms ongoing leprosy transmission in Central India. To achieve the goal of "Zero Leprosy," healthcare systems must urgently optimize early detection frameworks, integrate novel chemoprophylactic regimens and vaccines, and actively address socio-economic barriers to care.

Keywords: Hansen's disease, multibacillary leprosy, *Mycobacterium leprae*, Bacillary Index.

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Introduction

Leprosy, or Hansen's disease, remains a chronic infectious challenge caused by *Mycobacterium leprae*, primarily affecting the skin and peripheral nerves [1]. The disease manifests across a clinical spectrum determined by the host's immune response, traditionally categorized by the Ridley-Jopling classification [2]. While global efforts and the National Leprosy Eradication Programme (NLEP) have significantly reduced prevalence, transmission persists, particularly among marginalized communities and scheduled tribes in India [3,4,5]. Current strategies focus on the ambitious "Zero Leprosy" vision, aiming for zero transmission, disability, and stigma. [6] However, achieving this goal requires addressing persistent diagnostic gaps and socio-economic barriers to care. The present study was conducted to determine the pattern, prevalence and trends of slit-skin smear positive (SSS) positive leprosy cases diagnosed at our tertiary care hospital across five blocks in East Vidarbha region over a five-year period from 2020 to 2025.

Material and Methods

This study was undertaken at the Department of Microbiology, Indira Gandhi Government Medical College, Nagpur, a tertiary care institution. A retrospective analysis was conducted on leprosy cases from five administrative blocks (Bramhapuri, Nagbhid, Sindewahi, Mul, and Saoli) in the East Vidharbha region of Central India. All included cases were confirmed by slit-skin smear examination between January 2020 and February 2025. The study population included all smear-

positive patients identified from the pool of suspected cases, regardless of age or gender. Slit-skin smears, obtained from bilateral earlobes and two active lesions via the standard slit-and-scrape method. The smears were stained with modified Ziehl- Neelsen (ZN) stain and examined under oil immersion to look for both intra and extracellular acid-fast bacilli and reported accordingly. Bacteriological indices were calculated. Data were subsequently stratified by sex, age group, year of presentation, and type of leprosy.

Bacteriological index (BI): Density of lepra bacilli in smears including both solid and fragmented forms, BI is obtained by adding up the index from each site examined and dividing by the total by number of sites examined.

According to Ridley's Logarithmic Scale, Ranges of BI are:

- 1+: 1-10 bacilli/100 fields.
- 2+: 1-10 bacilli/10 fields.
- 3+: 1-10 bacilli/one field.
- 4+: 10-100 bacilli/one field.
- 5+: 100-1000 bacilli/one field.
- 6+: > 1000 bacilli/one field.

Results

During the study period, a cohort of 502 clinically suspected individuals was evaluated. Of these, a total of 239 slit-skin smear-positive cases were documented throughout five blocks. Males were predominantly affected with 155 cases (64.9%) compared to females with 84 cases (35.1%), yielding a male-to-female ratio of 1.8:1. (Table 1)

The study population showed a mean age of 42.3 ± 18.5 years. The peak incidence occurred in the 41-50 years age group (56 cases, 23.4%), followed by 51-60 years (48 cases, 20.1%) and 31-40 years (45 cases, 18.8%). Age group 0-10 years comprised 5.0% of the cohort, reflecting ongoing transmission in the community. (Table 2)

High bacillary index cases (BI 5+ and 6+) constituted 51.9% of the study population, with BI 6+ being the most common category (77 cases, 32.2%). This high proportion of high-BI cases indicates significant bacterial load and potential infectivity among detected cases. The mean BI was 4.2 ± 1.8, suggesting substantial bacillary burden in the population. (Table 3)

There was a notable surge in case detection in 2023 (88 cases, 36.8%). This was followed by a slight decline in 2024 (72 cases, 30.1%). The peak detection in 2023 may reflect improved surveillance, awareness campaigns, or genuine disease prevalence variations. The average annual case detection was 47.8 ± 25.3 cases over the five-year period. (Table 4) The study cohort comprised predominantly multibacillary (MB) cases (171 cases, 71.5%) versus paucibacillary (PB) cases (68 cases, 28.5%), indicating a high burden of potentially infectious disease. According to the Ridley-Jopling classification, borderline lepromatous (BL) cases were most prevalent (87 cases, 36.4%), followed by lepromatous (LL) cases (48 cases, 20.1%), collectively representing 56.5% of the cohort with very high infectivity. New cases comprised 79.1% of presentations, while relapse or re-treatment cases accounted for 20.9%, reflecting adequate surveillance and case identification systems. (Table 5)

Table 1: Sex Distribution of Smear-Positive Cases

Sex	Number of Cases	Percentage (%)	M:F Ratio
Male	155	64.9	1.8:1
Female	84	35.1	
Total	**239**	**100.0**	

Table 2: Age-Wise Distribution of Smear-Positive Cases

Age Group (years)	Number of Cases	Percentage (%)	Mean Age (SD)
0-10	12	5.0	42.3 ± 18.5
11-20	18	7.5	
21-30	34	14.2	
31-40	45	18.8	
41-50	56	23.4	
51-60	48	20.1	
>60	26	10.9	
Total	**239**	**100.0**	

Table 3: Analysis of Bacillary Index (BI) Among Smear-Positive Cases

Bacillary Index	Number of Cases	Percentage (%)	Mean Age (SD)
1+	36	15.1	
2+	15	6.3	
3+	36	15.1	4.2 ± 1.8
4+	28	11.7	
5+	47	19.7	
6+	77	32.2	
Total	**239**	**100.0**	

Table 4: Year-Wise Distribution of Smear-Positive Cases

Year	Number of Cases	Percentage (%)
2020	36	15.1
2021	31	13.0
2022	39	16.3
2023	88	36.8
2024	72	30.1
Feb-2025	13	5.4
Total	**239**	**100.0**

Table 5: Distribution of Cases as Per Type of Disease

Classification System	Type	Number of Cases	Percentage (%)	High Infectivity
WHO Classification	Paucibacillary (PB)	68	28.5	No
	Multibacillary (MB)	171	71.5	Yes
Ridley-Jopling Classification	Tuberculoid (TT)	24	10.0	No
	Borderline Tuberculoid (BT)	42	17.6	Low
	Mid-Borderline (BB)	38	15.9	High
	Borderline Lepromatous (BL)	87	36.4	Very High
	Lepromatous (LL)	48	20.1	Very High
Clinical Status	New Cases	189	79.1	—
	Relapse/Re-treatment	50	20.9	—

Discussion

In present study, male preponderance was observed in 64.9% cases, which is in concordance with trends prevalent in our country where males frequently self-report for treatment while females are slower to report. Increased mobility and frequent interaction with the community also lead to increased opportunities for contacts in males. These findings align closely with study conducted by Mathan and Devan [7], who reported a 64% male demographic among cases in a tertiary care hospital, as well as Gupta *et al.* [8], who attributed this to occupational exposures and delayed reporting.

The majority of cases in our study, 71.5% belonged to the multibacillary (MB) type, with high bacillary indices (BI) ≥5 in 51.9%. This dominance of multibacillary cases correlates with other studies like Arora *et al.* [9] and Pandey *et al.* [10] Similarly, Rao and Moodalgiri [11], alongside Relhan *et al.* [12], confirmed this sustained MB burden, signaling ongoing transmission despite the integration of leprosy care into the general health care system.

Age-wise analysis reveals a peak incidence in the 41-50 years age group, reflecting vulnerability within the productive age population. This demographic pattern, combined with the presence of pediatric cases of 5%, indicates the persistence of the disease within the community. These findings are consistent with the shifts reported by Pandey *et al.* [10], the stable detection trends observed by Mahajan *et al.* [13]. Similarly, recent studies conducted by Kulkarni *et al.* [14], Hazarika *et al.* [15], and Kumar *et al.* [16] observed a comparable rural bias, with maximum case detections concentrated within the 20 to 49 years age bracket.

A notable finding in the present study is the substantial increase in cases during 2023, accounting for 36.8% of the total. This surge mirrors the evolving clinical presentations and elevated rates of reactions and disabilities previously documented by Arora *et al.* [9] and Gupta *et al.* [8], likely stemming from either recent surveillance gains or the uncovering of hidden endemicity.

Furthermore, we observed high relapse and re-treatment rates of 20.9%, alongside a high

prevalence of borderline-lepromatous and lepromatous cases of 56.5%. These factors underscore the critical need for strict treatment adherence and parallel the post-elimination challenges such as reactions and disabilities, highlighted by Dimri *et al.* [17], Singal *et al.* [18] and Tegta *et al.* [19]. Ultimately, these findings from both northern and southern cohorts reinforce the specific epidemiological profile of Central India.

Conclusion

This study confirms that leprosy remains a significant public health challenge in Central India, evidenced by high rates of multibacillary cases and ongoing transmission in the post-elimination era. The pursuit of "Zero Leprosy" demands an urgent optimization of early detection frameworks to prevent irreversible neuropathic disabilities. This clinical vigilance must be actively complemented by the integration of novel chemoprophylactic regimens and prophylactic vaccines into national disease control programs. Furthermore, healthcare systems must maintain a high index of clinical suspicion for atypical cases and actively address socio-economic barriers that hinder marginalized populations from accessing timely dermatological care.

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