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Original Article

Clinicohistopathological Profile of Leprosy Patients in a Tertiary Medical College in Central Uttar Pradesh

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ABSTRACT

BACKGROUND: Leprosy is a chronic infectious disease caused by mycobacterium leprae, which can lead to permanent disability and facial deformity if not identified and treated accordingly. In this study, we have attempted to classify leprosy and study its histopathological pattern along with its clinical presentation in a tertiary medical college in Uttar Pradesh.
AIM AND OBJECTIVE: To study the clinicohistopathological profile of leprosy patients in a tertiary medical college in central uttar pradesh.
MATERIAL AND METHODS: Forty eight patients clinically suspected of leprosy and finally diagnosed on skin biopsy were included in the study from July 2022 to July 2025. The skin biopsies were processed and stained using H & E stain (Hematoxylin and Eosin) and Acid fast stain(AFB) using 5% H_2So_4 (Sulfuric acid). All the cases were finally diagnosed as leprosy were classified under the Ridley Jopling's classification.
RESULTS: Out of total 48 patients, BLL was diagnosed as the most common form of leprosy by histological examination (29.1%) while LL was the most frequent form of leprosy diagnosed on clinical examination (33.3%). The overall agreement between the clinical and histological diagnosis was 70.8%.
CONCLUSION: In our study, a relatively high percentage of cases of combined borderline lepromatous leprosy (BLL), LL, ENL and HL cases indicate the continuing trend of leprosy cases in the region with high bacterial load despite being declared eliminated in India. Our study also emphasizes on the key role of Ridley Jopling classification in effective categorization and treatment of leprosy.

Keywords:*Leprosy; Ridley Jopling Classification; Histopathology, HL.*

INTRODUCTION

Leprosy also known as Hansen's disease is believed to be oldest disease of mankind. [1] Caused by bacterium, Mycobacterium leprae, it is a chronic infectious disease which causes various skin lesions consisting of many hypopigmented hypoaesthetic macules, erythematous nodular lesions , ulcers , peripheral nerve damage and autoamputation of toes and fingers.[2] Additionally it can also cause facial deformity, hence besides imposing a significant public health challenge, leprosy is linked with both poverty and social stigma.

Since the implementation of national leprosy eradication programme and introduction of Multi drug therapy (MDT) launched since 1982 [3] there has been a declining trend of leprosy cases, and though it was declared eliminated in 2005, [4] still fresh new cases are being reported every year in India with a high prevalence rates of leprosy in states of Bihar, Uttar Pradesh and Chattisgarh. [5]

Classification of leprosy plays an important role in its diagnosis. The most widely used and the most accepted classification system of leprosy is the Ridley Jopling classification introduced in 1966 [6] which classifies leprosy on

clinical, histological and immunological basis. It divides leprosy into indeterminate(IL) , borderline tuberculoid (BT) ,pure tuberculoid (TT), Mid borderline (BB) , Borderline lepromatous (BLL) and pure Lepromatous leprosy (LL). The WHO classification of leprosy simply divides it into the paucibacillary (1-5 lesions) and multibacillary type (≥ 6 lesions) with three types IL, BT and TT being included in the paucibacillary type and the BB, BL, LL in the multibacillary type and is used mainly for treatment purposes and not for histological classification. [7]

As the clinical appearance of leprosy lesions maybe similar or overlap in many different forms of leprosy, skin biopsy followed by histopathological examination and subsequent lepra bacilli staining is the confirmatory method of diagnosing and classifying leprosy, based on which treatment can be decided. Many studies in the past have been conducted in different regions of India on the clinicohistopathological correlation of leprosy in which there has been varying percentages of agreement between the clinical and the histopathological diagnosis[8,9,10,11,12,13,14] . As the leprosy cases continue to occur and Uttar Pradesh being one of the main contributor of the disease amongst the Indian states, 5 as stated earlier, we have conducted a study on clinicohistopathological profile of leprosy patients in a tertiary medical college of Kanpur located in Central Uttar Pradesh, besides emphasizing the type of leprosy predominating in the region, most affected age group and the type of skin lesion predominating in each specific form of leprosy.

MATERIAL AND METHODS

This was a retrospective study in which we have included 48 patients diagnosed of leprosy on skin biopsy starting from July 2022 to July 2025. We have excluded those patients who were already on leprosy treatment.
Skin biopsies were received in 10% formalin, processed, embedded in paraffin wax and stained by H & E stain.
Lepra stain using modified Z.N (Ziehl Neelson stain) was done using 5% H_2So_4 (Sulphuricacid) for decolourisation.
Based on histologic features and analysing the bacillary index, leprosy was diagnosed and classified according to the Ridley Jopling system.
Bacillary index was assessed on the basis of Ridley's logarithmic scale in oil immersion lens

Ridley logarithmic scale

0+	No bacilli seen in 100 fields
1+	1-10 bacilli in 100 fields
2+	1-10 bacilli in 10 fields
3+	1-10 bacilli in an average field
4+	10-100 bacilli in an average field
5+	100-1000 bacilli in an average field
6+	>1000 bacilli in an average field

AIMS AND OBJECTIVES:

1. To classify the leprosy cases on skin biopsy according to Ridley Jopling classification.
2. To evaluate the percentage of agreement between the clinical type of leprosy to the respective histological type of leprosy.
3. To study the additional demographical characteristics of leprosy patients including age group, gender and clinical lesions.

RESULTS

Out of total 48 patients, BLL was diagnosed as the most common form of leprosy by histological examination (29.1%) while LL was the most frequent form of leprosy diagnosed on clinical examination (33.3%). The overall agreement between the clinical and histological diagnosis was 70.8%.

TABLE NO. 1

Age wise distribution of leprosy patients

SERIAL NO.	AGE RANGE	TOTAL NUMBER OF PATIENTS :48
1.	0-10	0
2	11-20	4
3.	21-30	3
4.	31-40	8
5.	41-50	10
6.	51-60	8
7.	61-70	7
8	71-80	3
9.	81-90	1
10	91-100	0

TABLE NO. 2
Classification of Leprosy Patients by Ridley Jopling System on Histopathology

SERIAL NO.	TYPE OF LEPROSY CLASSIFIED BY RIDLEY JOPLING SYSTEM ON HISTOPATHOLOGY	NUMBER OF PATIENTS IN EACH TYPE AND THEIR RESPECTIVE PERCENTAGE (TOTAL NUMBER OF PATIENTS – 48)
1.	INDETERMINATE LEPROSY (IL)	5 (10.4%)
2.	BORDERLINE TUBERCULOID LEPROSY (BT)	9 (18.75%)
3.	TUBERCULOID LEPROSY (TT)	6 (12.5%)
4.	MID BORDERLINE (BB)	1 (2%)
5.	BORDERLINE LEPROMATOUS (BLL)	14 (29.16%)
6.	LEPROMATOUS LEPROSY (LL)	9 (18.75%)
7.	HISTOID LEPROSY (HL)	1 (2%)
8.	ERYTHEMA NODOSUM LEPROSUM (ENL)	3 (6.25%)

Table No 3 –
Gender Wise Distribution of Leprosy Patients in each Category by Ridley Jopling System on Histopathological Examination

SERIAL NO	TYPE OF LEPROSY CLASSIFIED BY RIDLEY JOPLING SYSTEM ON HISTOPATHOLOGY	NUMBER OF PATIENTS IN EACH TYPE	MALES	FEMALES
1.	INDETERMINATE LEPROSY (IL)	5	4	1
2.	BORDERLINE TUBERCULOID LEPROSY (BT)	9	4	5
3.	TUBERCULOID LEPROSY (TT)	6	2	4
4.	MID BORDERLINE (BB)	1	1	0
5.	BORDERLINE LEPROMATOUS LEPROSY (BLL)	14	10	4
6.	LEPROMATOUS LEPROSY (LL)	9	7	2
7.	HISTOID LEPROSY (HL)	1	1	0
8.	ERYTHEMA NODOSUM LEPROSUM (ENL)	3	2	1

Table No 4:
Distribution of patients classified clinically and histologically in each category and percentage of agreement between them

Serial No	Type of leprosy classified clinically	Number of patients	Type of leprosy classified histologically	Number of patients	Percentage of agreement between clinical and histological classification
1.	IL	2	IL	5	40%
2.	BT	12	BT	8	75%
3.	TT	6	TT	6	100%
4.	BB	2	BB	1	50%
5.	BLL	5	BLL	14	35.7%
6.	LL	16	LL	10	62.5%
7.	HL	1	HL	1	100%

8.	ENL	4	ENL	3	75%

TABLE No.5

Type of skin lesions seen in different forms of leprosy classified histologically.

Serial No.	Type of lesion	IL	BT	TT	BB	BLL	LL	HL	ENL	TOTAL -48
1.	HYPERPIGMENTED ERYTHEMATOUS LESION	1	4	3	1	8	3	0	0	20 (41.6%)
2.	HYPOPIGMENTED HYPOAESTHETIC LESIONS	4	4	3	0	1	0	0	0	12(25%)
3.	ULCERATED LESIONS	0	0	0	0	2	4	0	0	6 (16.6%)
4.	NODULAR LESION	0	0	0	0	3	3	1	3	10 (20.8%)

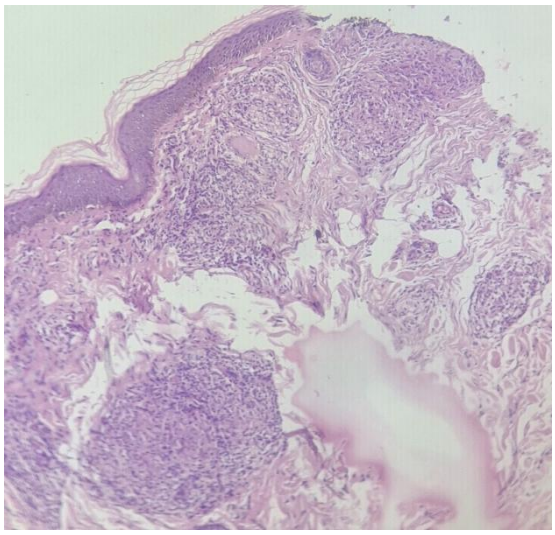
TABLE NO 6: Bacillary index in different types of leprosy assessed on skin biopsy

Serial No	TYPE OF LEPROSY ON HISTOLOGY	0 +	1+	2+	3+	4+	5+	6+	TOTAL NUMBER OF CASES
1.	IL	5	0	0	0	0	0	0	5
2.	BT	6	3	0	0	0	0	0	9
3.	TT	6	0	0	0	0	0	0	6
4.	BB	1	0	0	0	0	0	0	1
5.	BLL	0	0	0	6	8	0	0	14
6.	LL	0	0	0	0	4	5	0	9
7.	HL	0	0	0	0	0	0	1	1
8.	ENL	0	0	0	0	1	2	0	3

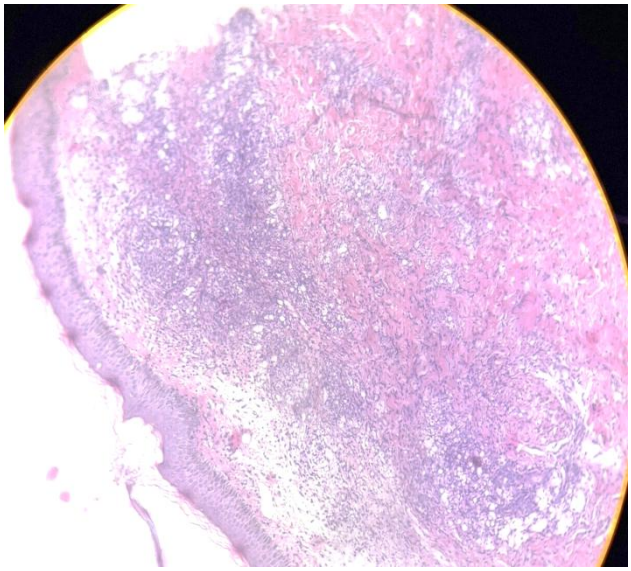
In our study, 48 cases of leprosy were diagnosed clinically and histologically studied, the most common type of leprosy was Borderline lepromatous leprosy (BLL) on histopathology (29.1%), followed by LL and BT which shared equal percentage of cases (20%) with LL type being the commonest on clinical examination (33.3%). Maximum clinicohistopathological agreement was seen in TT (100%) and HL cases (100%). The overall agreement between all clinical and histopathological forms of leprosy is 70.8% (34/48) cases. The most common age group affected by leprosy in our study was between 41-50 years (10/48 cases -20.8%) , followed closely by 8 cases each (16.6%) in age group of 31-40 and 51-60 years. The less affected age group was 11-20 years (8 %), 71-80 and 21-30 years both (6.2%), 81-90 years (4%), while no leprosy case was reported in extremes of ages 1-10 years and 91-100 years. Males comprised the majority of the leprosy cases 31/48- 64.5% cases. The most common type of skin lesion observed was an erythematous hyperpigmented lesion (41.6%), followed by hypopigmented hypoaesthetic lesions (25%), Ulcerated lesions comprised of 20% cases and nodular lesions consisted of 16%.

MICROPHOTOGRAPH 1

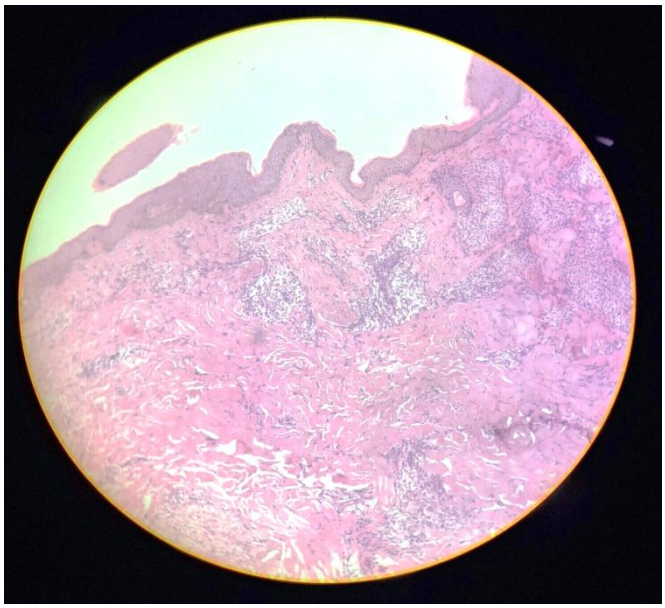
Pure tuberculoid leprosy (TT) – Skin biopsy showing atrophied epidermis with granulomas encroaching the epidermis along with a Langhan giant cell. (H & E stain, 100x)



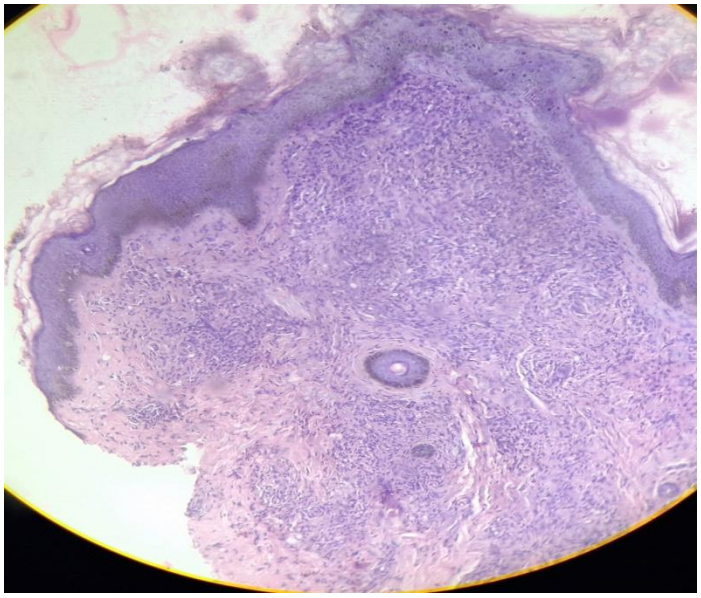
Microphotograph 2
Pure Lepromatous Leprosy (LL): Section shows epidermis with underlying epidermis showing sheets of foamy macrophages. (H & E stain, 100x)



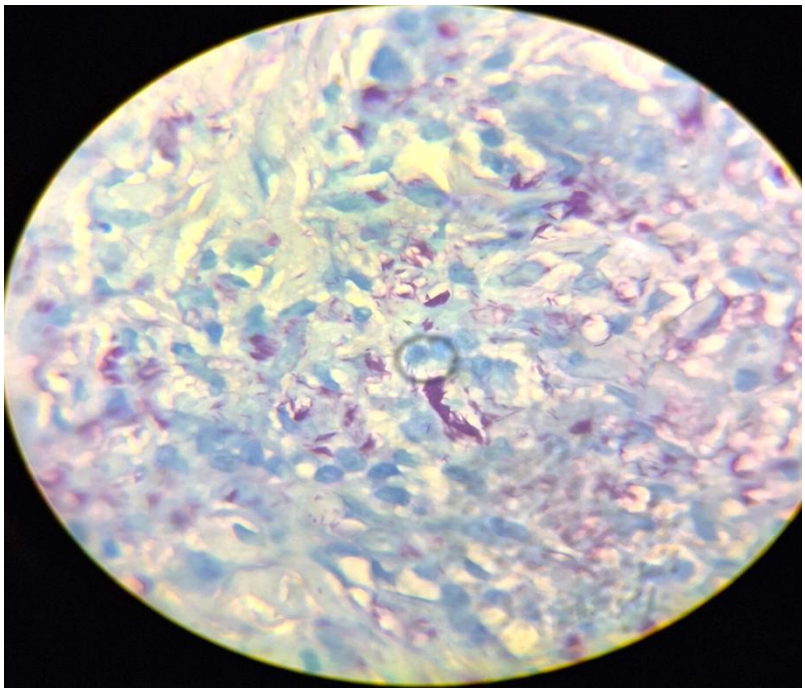
Microphotograph 3
Borderline Lepromatous Leprosy (BLL): Section shows epidermis with underlying dermis showing collections of foamy macrophages at focal places. (H & E stain, 100x).



Microphotograph 4
Histioid Leprosy (HL): Section shows epidermis with sheets of spindle shaped macrophages around adenexal structures. (H & E stain, 100x).



MICROPHOTGRAPH 5: Section shows bacillary index of 6+ on 5% AFB stain in a patient of histoid leprosy (1000x).



DISCUSSION

In our study, the overall agreement between clinical and histopathological diagnosis of leprosy was 70.8% which is within the range of percentage of agreement observed in previously conducted studies [8-15]. (Table No. 7). We have also included 1 case of HL and 3 cases of ENL in our study as HL is recognized as a highly active and uncommon variant of LL[16] and ENL is an immunologic complication, arising from treatment of LL or BLL. [17]

Table No. 7: Varying percentages of agreement between the clinical diagnosis and histopathological diagnosis of leprosy by the Ridley Jopling classification system in various studies.

Serial No.	Study conducted	Percentage of total agreement
1.	Neeha et al [8]	50%
2.	Balaji T.G et al [9]	62%
3.	Sharma A et al [10]	53.44%
4.	Semwal et al [11]	62%
5.	Bhatia A.S et al [12]	69%
6.	Kar et al [13]	70%
7.	Lobo et al [14]	65%
8.	Moorthy et al [15]	62.63%

All cases of pure TT and one case of HL diagnosed clinically, showed 100% agreement with its histological diagnosis, as in both forms of leprosy the diagnosis was readily made on clinical examination. A 100% agreement in TT type was also reported by Neeha et al[8] and Balaji T.G et al [9]. As TT cases mostly present with less number of hypoaesthetic hypopigmented skin lesions [2] and HL is also diagnosed clinically by presence of multiple nodules[2] and the respective forms also had the similar presentation in our study (Table No 5).On histopathology TT showed presence of multiple granulomas centered around perineurium, encroaching the epidermis, which was a characteristic feature in all cases and a bacillary index of 0 on 5% AFB stain. (Microphotograph 1). In HL, histologic appearance was that of many spindle shaped foamy macrophages surrounding the adenexal structures and perineurium with a BI of 6+. (Microphotograph 4, 5) BT and ENL showed the second best agreement with clinicohistological correlation in 75% of cases. Out of 4 cases of ENL, diagnosed clinically, 3 were correlated on histological examination, as ENL usually presents with fever, painful nodules, vesicles or ulcers [17] so its presentation is quite characteristic. One case was diagnosed as LL on histopathology. In BT, the clinical diagnosis outnumbered the histological diagnosis in 4 cases, while it showed agreement in 8 cases. In 4 cases which showed disagreement, 1 case was diagnosed as IL (indeterminate) type, another one as midborderline (BB) and the remaining two as TT and BLL respectively. As the clinical presentation of leprosy is highly variable, ranging from hypopigmented lesions to erythematous lesions in a single patient, so interobserver variation and subsequent interpretation of the form of leprosy is very common and also histological appearance depends on the stage of lesion being biopsied, hence all these factors could contribute to the variations in clinicohistopathological correlation. Few studies[10, 11] have recommended the use of paired biopsies i.e the biopsy should be taken from two morphologically

dissimilar lesions in the same patient to reduce the disparity between clinical and histological diagnosis and to determine the shift in the form of leprosy.

Least agreement was observed in BLL in only 5 cases (35%) as BLL is usually not precisely recognized and is mostly classified as LL clinically and is confirmed on histological examination and bacillary index. Conversely the LL cases were more on clinical examination (16/48) and comparatively less were diagnosed on histopathological examination (10/48) as the histological features were confirmatory in differentiating between BLL and LL. As LL showed many diffuse sheets of foamy macrophages surrounding adenexal structures and a clear Grenz zone (Microphotograph 2) , while BLL shows comparatively less and focal collections of foamy macrophages (Microphotograph 3) . A 4+ or 5+ BI is usually seen in LL while it is 3+ in BLL.

In our study males were found to be more affected from leprosy than females (31/48) cases which is consistent with the most of the previously conducted studies. [8, 9, 10, 11, 18, 19] An interesting observation also made in our study was the occurrence of more number of paucibacillary forms (IL, BT, TT) in females than multibacillary forms (BL, LL, HL, ENL) which were reported more in males. (Table No 3). A possible reason for this could be the confinement of females in homes more than men, who are more exposed to outside environment due to employment and frequent migration which could have contributed to the higher infectivity of the disease [8].

Overall most leprosy cases were seen in 31-70 years (33/48-68.7%) which indicates the common occurrence of leprosy in mostly middle age and slightly elderly age group. Children and adolescents (1-20 years) and elderly age (> 80 years) were least affected by leprosy, however in our study 4 patients in age group of 11-20 years were affected by leprosy , two were diagnosed with IL form of leprosy , one with BT and other with LL type. The presence of child leprosy is perceived significantly from the epidemiological point of view as it indicates active spread of leprosy in the population. [2]

In our study, most common form of leprosy diagnosed on histopathology was BLL comprising of 29.1% cases, followed by LL and BT each with 18.75%. Borderline leprosy cases either BLL or BT were the most commonly reported forms in most of the studies as the borderline forms keep changing their morphological spectrum according to the immunological status and progression of the disease. Neeha et al [8], Balaji T.G et al [9], Sharma et al [10], Semwal et al[11], Roy et al [20], reported BT as the most common form of leprosy , while Sinha et al [21] and Khamankar et al[22] reported BLL and LL as the most common form of leprosy respectively. Overall the multibacillary forms (BLL+LL+HL+ENL-28/48) dominated the paucibacillary forms (IL+BT+TT-20/48) in our study. More number of multibacillary cases in our study could also due to the fact that as our hospital is situated in vicinity of rural areas, so the patients included might be of low socioeconomic status, hence overcrowding, malnutrition subsequently leading to low immunity could have resulted in increased number of BLL and LL cases.

Erythematous hyperpigmented lesions as the predominant clinical lesion was found to be present in most of the patients in our study, especially in cases of BLL (8/20) (Table No 5), while they were also present in few cases of BT, TT and LL. On the other hand hypopigmented, hypoaesthetic lesions were seen more in paucibacillary forms (IL+BT+TT). Ulcerated lesions and nodular lesions were seen in varying numbers in LL, HL and ENL, but not in IL, BT and TT. This is in concordance with the usual clinical presentation of multibacillary forms (BLL, LL, HL) which present with a variety of lesions consisting of multiple symmetrical erythematous plaques, nodules and ulcerated lesions while hypoaesthetic hypopigmented lesions are seen more in paucibacillary forms. [2]

PCR is a valuable adjunct for diagnosing leprosy in cases where modified Ziehl–Neelsen staining results are negative. Despite its advantages, modified Ziehl–Neelsen staining remains essential in low-resource settings due to its accessibility and cost-effectiveness. Incorporating PCR in casesZiehl–Neelsen staining shows negative results, it can enhance the overall diagnostic yield [23,24]

CONCLUSION

Predominance of multibacillary forms of leprosy (BLL+ LL + HL + ENL) was reported in our study which points towards a active spread of leprosy cases in the region, besides conveying that leprosy has stayed as a common infectious disease in India, besides tuberculosis and still many of the cases remain underreported and undiagnosed due to the social stigma attached to the disease and lack of awareness. Our study also emphazises the importance of clinicohistological correlation of leprosy via the Ridley Jopling system of classification for its accurate diagnosis, immunological status, treatment and outcome.

Declarations:
Conflicts of interest: There is not any conflict of interest associated with this study
Consent to participate: There is consent to participate.
Consent for publication: There is consent for the publication of this paper.
Authors' contributions: Author equally contributed the work.

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