International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Evaluation of Clinical Spectrum with Comparison of Bacteriological Index in Slit Skin Smear and Histopathology Among Newly Detected Hansen's Disease Patients

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OPEN ACCESS

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Received: 28-09-2025
Accepted: 13-10-2025
Available online: 31-12-2025

ABSTRACT

Background: India achieved the elimination of Hansen's disease (Leprosy) as a public health programme in 2005 but still new cases of Leprosy are detected in early as well as in the late stages of the disease with deformities and disabilities.
Aims and Objectives: The study was conducted to evaluate the clinical spectrum of newly diagnosed leprosy patients and to observe the correlation between the clinical profile with slit skin smear (SSS) and histopathological (HPE) features in different types of Leprosy.
Materials and methods: A Hospital Based Cross-Sectional Study on all the newly detected Hansen's disease attending Department of Dermatology at a tertiary care hospital in Assam between July 2021 to June 2022.
Results and observations: 35 new cases of Hansen's disease were diagnosed during the study period with an incidence of 0.18%. The age of the patients varied from 6 to 68 years with 60% of them in age group 21 to 40 years. Childhood Leprosy constituted 5.71%. Male to Female ratio was 2.1:1. Maximum patients were Manual labourers (34.28%). Most common type of skin lesion observed was Plaque (48.57%) with most lesions appearing over the Upper Limbs (45.71%). In the present study 82.8% had peripheral nerve thickening with 25.71% having single nerve involvement and 57.14% having multiple nerve involvement with Ulnar Nerve (71.4 %) being the most commonly involved. Majority of our patients (31.45%) were clinically diagnosed to have BT Leprosy followed by TTHD & LLHD (17.14% each). 31.43% of our patients had deformities of which most (2/3rd) had grade 1 deformity. Around 60% patients were smear positive for Acid Fast Bacilli(AFB). Patients at BTDH pole were more commonly smear negative and histologically confirmed. Overall clinico-histopathological concordance was 75.3% in our study, being maximum in BTHD, LLHD and Histoid Hansen (100%) concordance followed by BLHD (83%), TTHD (50%) and BBHD (20%).

Keywords: *Bacteriological, Skin Smear, Histopathology, Leprosy.*

INTRODUCTION

Leprosy, which is also known as Hansen's disease (or) Hanseniasis is one of the oldest diseases of mankind. Hansen's disease still remains an important public health problem in many parts of the world, with majority of cases being reported in India. Leprosy is a chronic infection caused by Mycobacterium leprae. The disease affects mainly the skin and peripheral nerves and other structures such as mucous membranes, reticuloendothelial system, bones , joints, eyes, testis, muscle, tendon, kidneys, adrenal glands, etc.

Every continent was once affected by leprosy and it has left a terrifying image in history and memory – of mutilation, rejection and exclusion from society.(1)

The clinical manifestations of leprosy are so vast and diverse and can mimic variety of unrelated diseases. Presentation of leprosy may vary from an insignificant skin lesion to extensive disease leading to severe deformity and disability.(2)

The Ridley Jopling classification is based on clinical, histological, bacteriological and immunological parameters and mainly based on the histology of skin lesions a five group system is formed – tuberculoid Hansen disease (TTHD), Borderline tuberculoid Hansen disease (BTHD), Mid borderline Hansen disease (BBHD), Borderline lepromatous Hansen disease (BLHD) and lepromatous Hansen disease (LLHD).(3)

In India, The National Eradication program was initiated in 1983 which took many measure to eliminate the disease from the country. In December 2005, Leprosy was declared eliminated as a public health problem from India when a prevelance rate of the disease reached 0.95/10,000 population. (4)

However new cases of Leprosy are still being detected from day to day. The present study was conducted to evaluate the clinical spectrum of newly diagnosed Hansen's disease and to observe the correlation between the clinical profile with slit skin smear (SSS) and histopathological (HPE) features.

AIMS AND OBJECTIVES

1. To evaluate the clinical spectrum of newly diagnosed leprosy patients.
2. To observe the correlation between the clinical profile with slit skin smear (SSS) and histopathological (HPE) features in different types of Leprosy.

MATERIALS AND METHOD

The study was a hospital based cross sectional study and was conducted from July 2021 to June 2022 on newly diagnosed Hansen's Disease attending the dermatology department in a tertiary care hospital in Assam. Institutional Ethical Clearance was obtained from the institution before conducting the study.

Inclusion criteria: All newly detected leprosy patients who were willing to participate, during the study period.

Exclusion criteria: Patients on anti leprosy drugs. Pure neuritic leprosy (PNL).Patients not willing to give consent for participation in the study.

Skin biopsy was taken from the most active lesion and was stained by Hematoxylin and Eosin and Fite method and examined

RESULTS AND OBSERVATIONS

INCIDENCE:

There were a total of 35 newly diagnosed Hansen's disease patients during the study.

AGE AND GENDER DISTRIBUTION:

Age group	Males	Females	Total
Less than 14 year	2 (5.71%)	0	2 (5.71%)
15-20 years	0	1 (2.86%)	1 (2.86%)
20-40 years	15 (42.86%)	6 (17.14%)	21 (60%)
40-60 years	6 (17.14 %)	2 (5.71%)	8 (22.85%)
More than 60 years	1 (2.86%)	2 (5.71%)	3 (8.57%)
Total	24 (68.58%)	11(31.42%)	35 (100%)

In our study, most of the patients belonged to the age group of 20-40 years (21,60%) followed by 40-60years (8,22.85%). Males outnumbered females in ratio of 2.1:1. The youngest patient was 6 years old male child and the oldest patient was a 68 years old male.

OCCUPATION:

Occupation	Male	Females	Total
Student	4(11.42%)	2 (5.71%)	6 (17.14%)
Manual worker	10 (28.57%)	2 (5.71%)	12(34.28%)
Housewife		7 (20%)	7 (20%)
Skilled	5 (14.28%)		5 (14.28%)
Semi skilled	5 (14.28%)		5 (14.28%)
Total	24 (68.58%)	11 (32.42%)	35 (100%)

The disease was more common among the manual workers in males (34.28%) and among housewives (20%) in females.

NUMBER OF LESIONS:

Number of skin lesions	Male	Female	Total
1	6(17.17%)	5 (14.28%)	11 (31.45%)
2 to 5	1 (2.85%)	2 (5.71%)	3 (8.56%)
6 to 10	5 (14.28%)	1 (2.85%)	6 (17.17%)
11 to 20	7 (20%)	2 (5.71%)	9 (25.71%)
More than 20	5 (14.28%)	1 (2.85%)	6 (17.17%)
Total	24 (68.58%)	11(32.42%)	35 (100%)

In our study, most of the patients (31.45%)had single lesions followed by patients having 11-20 lesions(25.71%).

MORPHOLOGY OF LESIONS

Morphology	Males	Females	Total	Peripheral nerve trunk	
				Single nerve	More than 1 nerve
Single patch	1(2.85%)	3(8.57%)	4(11.42%)	0	3
Multiple patch	4(11.42%)	3(8.57%)	7(20%)	2	4
Single plaque	5(14.28%)	2(5.72%)	7(20%)	2	2
Multiple plaque	9(25.71%)	1(2.85%)	10(28.57%)	5	4
Multiple type of lesions	5(14.28%)	2(5.72%)	7(20%)	0	7

Out of the 35 patients in the study, most of them presented with multiple plaques (28.57%) followed by multiple patch, single plaque and multiple type of lesions (20%).

CLINICAL DIAGNOSIS:

Sl no	Clinical diagnosis	Males	Females	Total
1	Tuberculoid	3	3	6 (17.14%)
2	Borderline tuberculide	7	4	11 (31.45%)
3	Mid borderline	4	1	5 (14.28%)
4	Borderline lepromatous	4	1	5 (14.28%)
5	Lepromatous	5	1	6 (17.14%)
6	Histoid	2	0	2 (5.71%)
	Total	25	10	35 (100%)

In our study, Six (17.14%) patients were diagnosed as TTHD, 11(31.42%) as BTHD, 5(14.28%) as BBHD, 5(14.28%)as BLHD, 6(17.17%) as LLHD and 2 patients (5.714%) as Histoid Hansen disease.

LEPRA REACTIONS:

Lepra reactions	Type 1	Type 2
Males	2 (5.71%)	1 (2.85%)
Females	3 (8. 57%)	
Total	5 (14.28%)	1 (2.85%)

In the present study, 5(14.28%) patients had Type 1 lepra reaction and 1 had type 2 lepra reaction. Type 1 reaction was most commonly seen in patients with BTHD in 4 (11.43%) patients, one (2.85%) patients had BLHD. Type 2 Reaction was present in 1(2.85%) LLHD.

DEFORMITY:

In this study, among 29 patients with peripheral nerve involvement, 11(31.42) patients had deformities and 18 patients had no deformity. Out of 11 patients with deformities,7 patients (20%) had grade 1 deformity and 4 patients (11.42%) had grade 2 deformity.

Deformity	Male	Female
Grade 1	5(15.38%)	2(5.71%)
Grade 2	3(8.57%)	1(2.85%)
	8(22.85%)	3(8.57%)

SLIT SKIN SMEAR POSITIVITY WITH BACTERIAL INDEX

Slit skin smear was done in all the 35 patients. Only 21 (60%) patients showed smear positive for Acid Fast Bacilli (AFB), remaining 14 patients with negative smear.

Clinical type	No. of cases	0	1+	2+	3+	4+	5+	6+
TT	6	5		1				
BT	11	8	3					
BB	5	1	1		1	2		
BL	5		1	2	2			
LL	6			1	2	2		1
HL	2			1	1			

0ut of 6 TTHD Patient, 5 had no AFB in slit skin smear and 8 out of 11 BTHD Patient also had no AFB in slit skin smear. Of the 5 cases of BLHD, 1 case had BI 1+, 2 cases had BI 2+, 2 cases had BI 3+. Of the 7 cases of LLHD, all the cases had BI >2+. Of the 2 cases of Histoid Hansen, both cases showed AFB in SSS (2+&3+)

SKIN BIOPSY AND HISTOPATHOLOGICAL REPORTS:

Skin biopsy was done in all the 35 patients. Borderline tuberculide was the most common histopathological diagnosis seen in 14(40%) patients, followed by lepromatous leprosy 7(20%), borderline lepromatous 6(18.75%), tuberculoid 3(8.57%), Histoid leprosy 2(5.71%), midborderline 2(5.71%) and intermediate(2.85%).

CLINICAL AND HISTOPATHOLOGICAL CONCORDANCE:

Clinical classification		Histological classification							Concordance clinical vs histopathology
Group	Total	INDTERMINATE	TT	BT	BB	BL	LL	HISTOID	
Indeterminate									
TT	6	1	3	2					50%
BT	11			11					100%
BB	5			1	1	3			20%
BL	5				1	3	1		83%
LL	6						6		100%
HISTOID	2							2	100%

The overall clinical and histopathological concordance was 75.3%. The maximum concordance (100%) was seen in BTHD, LLHD and Histoid. followed by BLHD with 83% concordance, TTHD with 50% concordance and BBHD 20%. (Table 12).

DISCUSSION

The total number of new cases who attended Dermatology OPD from July 2021 to June 2022 was 19329 out of which 35 (0.18%) were Hansen's disease patients.

The age of the patients in our study varied from 6 to 68 years, similar to another studies by Asilian A et al (5), and Badhan R et al.(6)

In our study 2 (5.71%) cases belonged to paediatric age group whereas higher values were found in studies by Thakkar et al (7) (12.3%) and in a study from south India (8) (12.1%).

The age group more frequently affected was 21 to 40 years (60%) in our study which is similar to studies done by(7),(9),(10) .

Among 35 patients 22 were males, 11 females and 2 male children with male to female ratio of 2.1:1. Several other studies have similar shown male preponderance, with the ratio ranging from 2:1 to 5:1 (7),(10),(11) .

In our study two (5.71%) patients had family history of Hansen disease similar to a study by Rijal et al from Nepal (12) showing that 4.2% had family members with Leprosy whereas Van beer (13) had observed a higher value of 28% new cases having household contact with previously diagnosed leprosy.

Peripheral nerve involvement in the form of thickening was seen in 29(82.8%) patients similar to a study from Mangalore (9) (76.01%) of thicknening nerve involvement. A study from Britain (14) showed that peripheral nerve enlargement was demonstrated in 50% only.

Out of 29 patients with peripheral nerve involvement,19 patients had trunk nerve involvement, 10 patients had nerve trunk and cutaneous nerve involvement. Single peripheral nerve involvement was seen in 9(25.71%), 20(57.14%) had more than 1 nerve involvement. Most common nerve involvement was Ulnar nerve in 25(71.4%), followed by Common

peroneal nerve in 20(57.14%), radial cutaneous nerve in 8(22.85%). Similarly, in a study by Shrestha et al (15), the common nerve trunk involved was ulnar nerve followed by Common peroneal nerve.

Out of 12 patients presented in polar spectra (TTHD-3, LLHD-7, Histoid-2), all 12 (100%) patients had nerve trunk involvement. Out of 23 patients presented with borderline spectra (BTHD-14, BBHD-1, BLHD-6), 19(54.28%) patients had nerve trunk involvement.

In this study, among 29 patients with peripheral nerve involvement, 11 patients had deformities and 18 patients had no deformity. Out of 11 patients with deformities,7 patients (20%) had grade 1 deformity and 4 patients (11.42%) had grade 2 deformity similar to the findings by Rathod et al (16) where 21.25% patient had grade 1 deformity and 6.31 % patient had grade 2 deformity. This is in contrast to the findings by Laldinthari et al (4) where 6.25% patients had grade 1 deformity and 43.75% patients had grade 2 deformity.

Borderline spectrum was the most common clinical diagnosis with borderline tuberculoid in 11(31.42%) patients followed by tuberculoid leprosy, lepromatous leprosy in 6(17.14%)patients and, midborderline and borderline lepromatoushansens in 5(14.28%)patients and histoid in 2(5.71%) patient. K N Shivaswamy et al (17) found TT in 17.5%, BT in 38.4%, BB in 2.7%, BL in 13.1% and LL in 12.6% of their patients. Badhan et al (6) found TT in 28.66%, BT in 36.7%, BB in 3.6%, BL in 6.6% and LL in 11.6% of their patients. Increased awareness of the people to leprosy because of many national programmes, educational status and social awareness, makes them to present at an earlier stage to leprosy clinics, which may contribute to increased number of borderline group of leprosy.

In our study, Type 1 reaction (5, patients 14.28%) was found more than Type 2 reaction. Type 1 reaction was most commonly seen in patients with BTHD in 4 (11.43%) patients, one (2.85%) patient had BLHD. Type 2 Reaction was present in 1(2.85%) LLHD

Koraput Leprosy Eradication Project (KORALEP), the data showed that T1R occurred in 3.9% of borderline cases and T2R in 23.7% of LL and BL cases. Of the borderline cases, borderline borderline (BB) type showed maximum rate of reactions. The BL type can present with both T1R and T2R with a total incidence of 12.8%. While borderline tuberculoid (BT) type constituted 74% of the total cases, T1R occurred in only 3.1% of cases.(18)

Slit skin smear positivity seen in our study was 60%, whereas similar studies carried out by Bhushan et al (19) in New Delhi and a tertiary care centre in UP (2016) (20) showed 56.58% and 43.8% respectively.

In our study 5 out of 6 clinically classified TT cases were AFB Negative. Amongst the BT cases, 11were AFB negative and the rest 3 were AFB positive (BI = 1+). Out of 5 BBHD patient one was AFB negative, and rest are AFB positive (BI =2+ to 4+). All the 5 BLHD patients were AFB positive (BI = 1+ to 5+). All the 6 clinically classified LLHD patients were AFB positive (BI = +2 to +6). And both the HISTOID hansen's were AFB positive (BI = 2+&3+). A study carried out by Kakkat et al (21) in Government medical college, western odisha, showed that all TTHD patients were AFB negative and BI was 0 to 4+, 2+ to 4+, 3+ to 5+, 4+ to 6+ in BTHD, BBHD, BLHD and LLHD respectively which was similar to that of our study except that one case of TTHD was AFB positive and one of BBHD case were AFB negative in our study. A study by Premalatha et al (22) showed, all TTHD cases were AFB negative and bacillary index was highest in HL followed by LL and low in BT.

A study from India reported a SSS positivity of 100% in LL and Histoid Hansens,86.4% in BL,38.8% in BT and none in clinic-pathologically diagnosed TT, Indeterminate and neuritic cases, and the overall positivity was 59.8%. (23,216)

Borderline tuberculoid was the most common histopathological diagnosis seen in 14(40%) patients followed by lepromatous leprosy in 7(20%) then 6(18.75%) patients diagnosed as borderline lepromatous, 3(8.57%) as TTHD and 2 patients belonging to BBHD (5.71%) and 2 Histoid Hansen's (5.71%) and 1 (2.85%) belongs to Indeterminate Hansen's. Similar to our study the most common type of leprosy diagnosed clinically as well as histopathologically was borderline tuberculoid in studies by Lobo et al(24),moorthy et al (25) and Bhushan et al (19)

There was an overall clinicohistopathological concordance of 75.3 % in this study with the rest showing disparity. This is similar to that observed in many studies by Badhan et al (6), Bhushan et al (19), Pandya et al (26). Concordance maximum in Borderline tuberculoid, lepromatous leprosy and histoid Hansen each with 100% concordance followed by borderline lepromatous 83% concordance Tuberculoid with 50% concordance and mid borderline 20 % concordance. The worst concordance was noted in Mid borderline leprosy, this may be due to immunological unstability of borderline cases.
This is similar to Kalla (27) et al where clinicopathological correlation was highest with LLHD (84.2%), followed by BLHD (73.3%), BTHD (64.1%),TTHD(56%) and BBHD(50%) concordance was observed. A study by Nitesh Mohan et all (28) showed Clinico-Histopathological concordance of LLHD (97.22 %),BTHD

(79.76%),TTHD(71.43),BLHD(66.67%),BBHD (66.67%)& ILHD(50%). 218. A study by DebeekaHazarika et al (29), found a overall clinico-histopathological correlation of 56.94%,with Maximal concordance noted in indeterminate leprosy (100%), followed by polar types i.e. LL (80%) and TT (75%). The least concordance was found in mid-borderline leprosy (16.66%) followed by BL (37.5%).

Various other studies showed a higher concordance in lepromatous leprosy and tuberculoidleprosy(7),(25),(27). It is believed that correlation is supposed to be better at polar spectra (lepromatous and tuberculoid) and it is probably related to clinical and histopathological stability of the disease, also they show a fixed histopathology, while borderline and indeterminate groups may have different histopathology in different site and lesion due to variable and unstable immunity.

CONCLUSION

We conclude from our study that there are still cases of leprosy in the society despite being declared as eliminated from the society in India and every year new cases are detected. This new detections may be due to increase in awareness among people and easily affordable health care services. Histopathological examination helps to arrive at a definite diagnosis and classify the type of Hansen's disease and thus helps in appropriate management of the cases.

BIBLIOGRAPHY

1. Ell SR. Leprosy in history. In: Hastings RC, Opromolla DVA, editors. Leprosy. 2nd ed. Singapore Publishers Pte Ltd; 1994.3-10.
2. Shantaram B, Yawalkar SJ. Leprosy – Differential Diagnosis. In: Valia RG, Valia AR editors, Textbook and Atlas of Dermatology, 2nd ed, Bombay, Bhalani Publishing House;1994. p.1385-1391.
3. Ridley DS, Jopling WH. Classification of leprosy according to immunity – a five group system. Int J Lepr. 1996; 34: 255-277.
4. ChhakchhuakLaldinthari ,ChhakchhuakLalbiakdiki , Rajesh Rongpi , Lalromawii , Sandhya George , PradeepBalasubramaniyan.: Clinical profile of newly diagnosed leprosy patients with special references to deformities and disabilities. Asian Journal of Medical Sciences | Sep 2023 | Vol 14 | Issue 9: 158-161. http://nepjol.info/index.php/AJMS DOI: 10.3126/ajms.v14i9.54498.
5. Asilian A, Faghihi G, Momeni A, Radan MR, Meghdadi M, Shariati F .Leprosy Profile in Isfahan (A Province of Iran). Int J Lepr. 2005; 73(2): 129-130.
6. Badhan R, Kundal RK, Raj RT, Bahl RK, Bal MS. A ClinicoPathological Correlation Study of Leprosy in a Tertiary Care Teaching Institute in Northwest Punjab, India. American Journal of Medical Sciences and Medicine. 2014; 2(5): 99108.
7. Thakkar S, Patel SV. Clinical profile of leprosy patients: A Prospective study. Indian J Dermatol. 2014; 59: 158-62.
8. Bijjaragi S, Kulkarni V, Suresh K K, Chatura K R, Kumar P. Correlation of clinical and histopathological classification of leprosy in post elimination era. Indian J Lepr.2012;84(4),271-275.
9. Bhat RM, Chaitra P. Profile of New Leprosy Cases Attending a South Indian Referral Hospital in 2011-2012.ISRN Tropical Medicine. 2013, Article ID 579024. Doi: 10.1155/2013/579024.
10. Nigam KP, Sehgal U, Ramesh V, Misra R S. Age of onset of leprosy. Indian J Dermatol Venereal Leprol.1990; 56: 213-5.
11. Arora M, Katoch K, Nataranjan M, Kamal R, Yadav VS. Changing profile of disease in leprosy patients diagnosed in a tertiary care centre during years 1995-2000. Indian J Lepr.2008;80:257-65.
12. Rijal A, Agarwal S, Bhattarai S .Do contacts have a role in transmission of leprosy. Nepal Journal of Dermatology, Venereology& Leprology.2012;10(1):16-19.
13. Van Beers SM, Hatta M, Klaster PR, patient contact is the major determinant in incident leprosy: implications for future control.Int J Lepr other mycobact Dis.1999; 67(2):119-28.
14. Gill AL, Bell DR, Wyatt GB, beeching NJ. Leprosy in Britain:50years experience in Liverpool.Q J Med.2005;98:505-511.
15. Shrestha A, Chauhan S, Mathuur M. Clinicohistopathological correlation of leprosy. Journal of pathology of Nepal 2017;7:1095-1102
16. Rathod SP, Jagati A and Chowdhary P. Disabilities in leprosy: An open, retrospective analyses of institutional records. An Bras Dermatol. 2020;95(1):52-56. https://doi.org/10.1016/j.abd.2019.07.001
17. Shivaswamy K N, Shyamprasad AL, Sumathy TK, Ranganathan C, Agarwal V. Clinical and histopathological correlation in leprosy. Dermatol online journal.2012;18(9):2.
18. Kar HK, Sharma P. Leprosy reactions. In: Kar HK, Kumar B, editors. textbook of leprosy. 1st ed. New Delhi: Jaypee Brothers Medical Publishers. 2010.p 269-289.
19. Premanshu B, Kabir S, Koranne RV, Choudhary M, Manjul P. Diagnosing multibacillary leprosy: A comparative evaluation of diagnostic accuracy of slit-skin smear, bacterial index of granuloma and WHO operational classification. Ind J DermatolVenereolLeprol 2008;74:322-6.

20. VandanaSardana, MD. "Rising Trends: Slit Skin Smear Positivity in Suspected Cases of Leprosy in A Tertiary Care Hospital in western Uttar Pradesh." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 16.9 (2017): 34-35
21. A Study of Clinical, Bacteriological &Histopathological Correlation in Leprosy Cases attending a Government Medical College in Western Odisha: Some Observations. Indian J lepr 2016 Apr;88(2):97-103.
22. Premalatha P, Renuka IV, Meghana A, Devi SI, Charyulu P, Sampoorna G. Utility of Bacillary Index in Slit Skin Smears in Correlation with Clinical and Histopathological Alterations in Hansen's Disease: An Attempt to Revive a Simple Useful Procedure. Ann Med Health Sci Res. 2016 May-Jun;6(3) 181-184. doi:10.4103/2141-9248.183936. PMID: 27398251; PMCID: PMC4924493.
23. Banerjee, Surajita&Biswas, Nibir& Das, Nilay&Sil, Amrita &Ghosh, Pramit&Reja, Abu HenaHasanoor&Dasgupta, Sarbani&Datta, Pijush& Bhattacharya, Basudev. (2011). Diagnosing leprosy: revisiting the role of the slit-skin smear with critical analysis of the applicability of polymerase chain reaction in diagnosis. International journal of dermatology. 50. 1522-7. 10.1111/j.1365- 4632.2011.04994.x.
24. Lobo AC, Pai RR, GautamKuruvila M. Correlation of clinicopathological classification of Hansen's Disease in a south Indian city.Indian J Lepr.2014;86:147154.
25. Moorthy B N, Kumar P, Chatura K R, Chandrasekar H R, Basavaraja P K. Histopathological correlation of skin biopsies in leprosy. Indian J dermatolVenereol Leprol.2001;67:299-301.
26. Pandya AN, Tailor HJ, clinicohistopathological correlation of leprosy. Indian J dermatolVenereol Leprol.2008;74:74-76.
27. Kalla G, Salodkar A and Kachhawa D. clinical and histopathological correlation in leprosy. Indian J Lepr. 2000;68:184-185.
28. Mohan, Nitesh& Mishra, Nitin. (2013). Clinicohistopathological correlation within the spectrum of hansen's disease: A multicentric study in North India. International Journal of Medical Research & Health Sciences. 2. 887. 10.5958/j.2319-5886.2.4.142.
29. Hazarika D, Pawar MK, Dowerah E. A prospective study of clinicohistopathological correlation among leprosy patients attending a tertiary referral centrein Assam,in this post elimination era. Int J Health Sci Res. 2017; 7(4):148-153.