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*Original Article*

# Neurological Manifestations in Leprosy: A Study in Tribal Community of Hill Tracts

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## *Abstract*

***Background**: Leprosy is a chronic granulomatous infectious disease having major burden on humans over thousands of years. If untreated, it results in permanent damage to various systems and organs. So we designed this study to evaluate the neurological complications in early stage in adult leprosy patients. **Objective**: The aim of this study was to find out the pattern of neurological manifestations among adult leprosy patients. **Materials and Methods**: This cross-sectional hospital-based study on 85 adult tribal leprosy patients was conducted in a district level health care facility from January to December 2014 using simple, direct, standardized questionnaire including history and neurological examinations. **Results**: The commonest age group affected was 18–30 years (62.4%). Male group was predominant (68.2%). Majority cases (66%) had multibacillary leprosy. At first visit 72.7% cases with neurological findings could not be diagnosed correctly by primary health care personnel. More than six months were required for correct diagnosis in 61.2% cases. Numbness was the commonest (74.5%) neurological symptom. In upper limb, motor findings were predominant with wasting in 50.9% cases. In lower limb, sensory findings were predominant with stock pattern sensory impairment being the commonest (56.4%). Ulnar nerve was the commonest peripheral nerve to enlarge with tenderness. Facial nerve was the commonest cranial nerve involved. All cases with multiple cranial nerves involvement were of multibacillary type. Due to physical disability 92.7% cases lost their jobs. **Conclusion**: In this study neurological involvement was found associated with severe disability.*

***Key words**: Leprosy; Numbness; Neuropathy; Disability*

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## Introduction

Leprosy is a chronic granulomatous infectious disease that has been a major burden on human over thousands of years.[1] If untreated, the disease is progressive and results in permanent damage to the skin, nerves, limbs and eyes.[1] It was recognized in the ancient civilizations of China, Egypt and India. The earliest report of leprosy dated back to 600 BC.[2] Perhaps no other disease in the history of mankind has been associated with such a strong social stigma as leprosy. Failure in early detection often leads to severe disability in spite of eradication of mycobacterium at a later date.[3,4] The most likely mode of transmission is through nasal secretions and skin contact. The disease is thought to be of low infectivity. In most populations, over 95% of individuals are naturally immune. In spite of this the disease accounts for approximately 10 million affected people worldwide.[5] Leprosy remained an incurable disease until 1940 when the first breakthrough occurred with the development of dapsone, a drug capable of arresting the disease.[6] Today it is widely accepted that

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multi-drug therapy (MDT) renders leprosy curable. With neurological complications leprosy causes more disability and increases burden to society. In developing countries there are not enough qualified healthcare personnel to detect the neurological complications in early stage of disease. With history, investigations and examination the neurological complications can be detected in the early stage. The aim of this study was to find out the pattern of neurological manifestations of leprosy in adults that can help to make early diagnosis of this disease and prevent devastating complications.

## Materials and Methods

This cross-sectional study was based on the interview and examination of the patients presented with the features of leprosy in the outpatient department. Total 85 subjects were included in this study. The study population included all those tribal patients who were diagnosed as leprosy cases at Rangamati Sadar Hospital during one year period from January to December 2014. Patients below 18 years of age were excluded. All the patients gave their consent to participate in the study. Detailed history was taken and proper systemic and neurological examinations were performed. The physical signs were grouped into general, systemic, dermatological and neurological. According to WHO, diagnosis of leprosy is clinical and is based on patients having one or more of three cardinal signs: i) hypopigmented or reddish patches with definite loss of sensation, ii) thickened peripheral nerves and iii) acid-fast bacilli on skin smears or biopsy material.[7] Investigations were needed only in cases where the diagnosis was doubtful or where recurrence was suspected. The disease is classified into paucibacillary (PB) and multibacillary (MB) leprosy according to WHO classification and standard regimens of MDT according to WHO therapeutic guidelines were used for the treatment of the patients included in the study.[8] The following drugs were used: rifampicin, dapsone and clofazimine. Neurological complications were searched thoroughly by central and peripheral nervous system examinations. Data were collected, tabulated and statistical analysis was performed using software SPSS 16.0 for Windows.

## Results

Among the 85 patients diagnosed as leprosy, multibacillary type was predominant (65.9%, n=56) and remaining 29 cases were paucibacillary. Among the cases, 55 (64.7%) presented with different neurological signs and symptoms, that is, the prevalence of neurological manifestation is high.

Table I shows the socio-demographic factors of leprosy patients. We found that 53 (62.4%) patients were aged between 18–30 years. Among the study subjects 68.2% were male, 61.2% were from rural area, 75.3% were previously employed, 72.9% had previous BCG vaccination and four patients had previous positive family history. Only one patient had previously diagnosed neurological disease. After 6 months of clinical manifestations, 61.2% were diagnosed correctly.

Table I: Distribution of leprosy patients according to socio-demographic factors (N=85)

| Socio-demographic factors | Number | Percentage |
|---|---|---|
| ***Age (years)*** | | |
| 18–30 | 53 | 62.4 |
| 31–45 | 18 | 21.2 |
| 46–60 | 11 | 12.9 |
| >60 | 3 | 3.5 |
| ***Sex*** | | |
| Male | 58 | 68.2 |
| Female | 27 | 31.8 |
| ***Residence*** | | |
| Urban | 33 | 38.8 |
| Rural | 52 | 61.2 |
| ***Previous employment*** | | |
| Employed | 64 | 75.3 |
| Unemployed | 21 | 24.7 |
| ***BCG vaccination*** | | |
| Yes | 62 | 72.9 |
| No | 18 | 21.2 |
| Not known | 5 | 5.9 |
| ***Positive family history*** | | |
| Yes | 4 | 4.7 |
| No | 81 | 95.3 |
| ***Past primary neurological disease*** | | |
| Yes | 1 | 1.2 |
| No | 84 | 98.8 |
| ***Duration before diagnosis*** | | |
| <6 months | 33 | 38.8 |
| >6 months | 52 | 61.2 |

On first visit to primary care personnel, out of 55 subjects with neurological complications only 15 (27.3%) cases were diagnosed properly, 40 (72.7%) cases could not be diagnosed or diagnosed wrongly leading to delay in initiation of treatment.

In our study we found 9 types of neurological symptoms in leprosy patients (Fig 1). Numbness was the commonest symptom (n=41, 74.5%). Limb weakness was found in 31 cases (56.4%) involving the upper limb and 24 cases (43.6%) involving the lower limb. Neuropathic pain was found in 14 patients. Other less common symptoms were upper and lower limb weakness, smelling disturbance, visual disturbance, headache and facial palsy. One patient complained of convulsion which was not fully investigated.

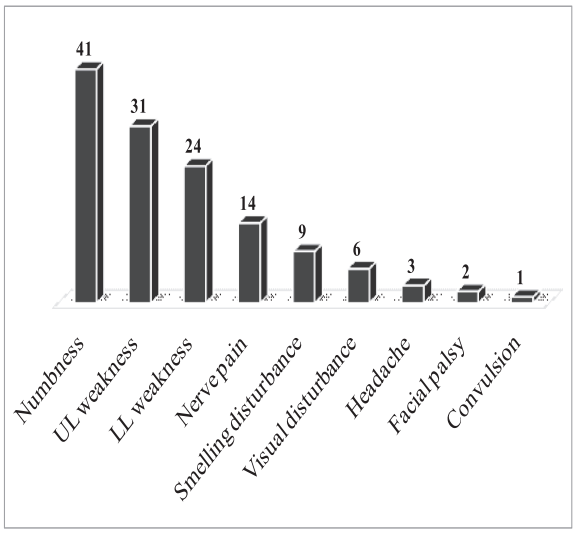


Fig 1. The common presenting neurological symptoms (some patients presented with multiple symptoms)

On proper examination and investigations for neurological deficits in upper limb we found that motor deficit was predominant compared with sensory deficits (Table II). Multibacillary (MB) cases showed more neurological findings. The commonest motor finding was wasting of muscles (n=28, 50.9%). Ulnar nerve weakness (45.6%) and median nerve weakness (38.2%) were also common. 'Gloves' pattern impairment (n= 12, 21.8%) was the commonest sensory impairment. Other common neurological findings were ulnar weakness (38.2%) and median weakness (21.8%). Less common findings were true claw, ulnar claw, loss of finger phalanges, simian deformity, hypotonia, hyporeflexia, ulcers, ulnar sensory impairment, median and radial cutaneous sensory impairment.

Table II: Neurological findings of leprosy in upper limbs (n=55)

| Clinical findings | MB Number (%) | PB Number (%) | Total Number (%) |
|---|---|---|---|
| Wasting | 23 (41.8) | 5 (9.1) | 28 (50.9) |
| Ulnar weakness | 20 (36.4) | 5 (9.1) | 25 (45.6) |
| Median weakness | 16 (29.1) | 5 (9.1) | 21 (38.2) |
| 'Gloves' pattern sensory impairment | 9 (16.4) | 3 (5.5) | 12 (21.8) |
| True claw | 7 (12.7) | 1 (1.8) | 8 (14.5) |
| Ulnar claw | 3 (5.5) | 2 (3.6) | 5 (9.1) |
| Hypotonia | 3 (5.5) | 2 (3.6) | 5 (9.1) |
| Hyporeflexia | 3 (5.5) | 0 (0.0) | 3 (5.5) |
| Simian deformity | 2 (3.6) | 1 (1.8) | 3 (5.5) |
| Ulcers | 2 (3.6) | 0 (0.0) | 2 (3.6) |
| Ulnar sensory impairment | 2 (3.6) | 0 (0.0) | 2 (3.6) |
| Median sensory impairment | 2 (3.6) | 0 (0.0) | 2 (3.6) |
| Radial cutaneous sensory impairment | 1 (1.8) | 0 (0.0) | 1 (1.8) |

MB, Multibacillary; PB, Paucibacillary

Our study also revealed neurological findings in lower limbs where sensory findings were more than motor findings (Table III). Again multibacillary cases showed more neurological findings. 'Stocks' pattern sensory impairment was the commonest (n=31, 56.4%). Wasting (n=19, 34.5%) was the commonest motor finding. Nine cases showed deep ulcers in feet due to sensory impairment.

Table III: Neurological findings of leprosy in lower limbs (n=55)

| Clinical findings | MB Number (%) | PB Number (%) | Total Number (%) |
|---|---|---|---|
| 'Stocks' pattern sensory impairment | 26 (47.3) | 5 (9.1) | 31 (56.4) |
| Wasting | 15 (27.3) | 4 (7.3) | 19 (34.5) |
| Deep ulcers | 6 (10.9) | 3 (5.5) | 9 (16.4) |
| Lateral popliteal sensory impairment | 4 (7.3) | 2 (3.6) | 6 (10.9) |
| Posterior tibial sensory impairment | 4 (7.3) | 1 (1.8) | 5 (9.1) |
| Loss of toe phalanges | 2 (3.6) | 1 (1.8) | 3 (5.5) |
| Drop feet | 2 (3.6) | 0 (0.0) | 2 (3.6) |
| Posterior tibial weakness | 2 (3.6) | 0 (0.0) | 2 (3.6) |
| Lateral poplitial weakness | 1 (1.8) | 0 (0.0) | 1 (1.8) |
| Hypotonia | 1 (1.8) | 0 (0.0) | 1 (1.8) |
| Impaired co-ordination | 1 (1.8) | 0 (0.0) | 1 (1.8) |

MB, Multibacillary; PB, Paucibacillary

Enlarged nerve was found on palpation. Tenderness was also elicited in some enlarged cases. Commonest nerve involved was ulnar nerve (n=22). Great auricular nerve, radial cutaneous nerve, lateral poplitial nerve, posterior tibial nerve involvement was also found (Table IV).

Table IV: Involvement of nerves in leprosy

| Nerve | Enlarged | Tender |
|---|---|---|
| Ulnar nerve | 22 | 13 |
| Great auricular nerve | 18 | 9 |
| Radial cutaneous nerve | 11 | 5 |
| Lateral popliteal nerve | 9 | 6 |
| Posterior tibial nerve | 11 | 7 |

Eight cases (14.54%) were found with cranial nerve involvement in our study. Multibacillary (MB) cases were more vulnerable for cranial nerve involvement. Facial nerve involvement was the commonest (n=6, 10.9%). Trigeminal, olfactory and auditory nerve involvement was also found (Table V).

Table V: Cranial nerve involvement in leprosy patients

| Cranial nerves | MB | PB | Total |
|---|---|---|---|
| Facial nerve | 4 | 2 | 6 |
| Trigeminal nerve | 2 | 1 | 3 |
| Olfactory nerve | 2 | 0 | 2 |
| Auditory nerve | 1 | 0 | 1 |

MB, Multibacillary; PB, Paucibacillary

Single cranial nerve involvement was found in most cases (n=5, 9.9%). Double (n=2) or triple (n=1) cranial nerve involvement was found only in multibacillary cases (Table VI). Due to delay in treatment with neurological complications most of the patients suffered from physical disabilities. Fifty one cases (92.7%) lost their job or business. They also suffered from physical dependence, immobility, pain and hampered regular activities (Fig 2).

Table VI: Number of cranial nerves involved in leprosy subjects

| Cranial nerve number | MB | PB | Total |
|---|---|---|---|
| 1 | 2 | 3 | 5 |
| 2 | 2 | 0 | 2 |
| >2 | 1 | 0 | 1 |

MB, Multibacillary; PB, Paucibacillary

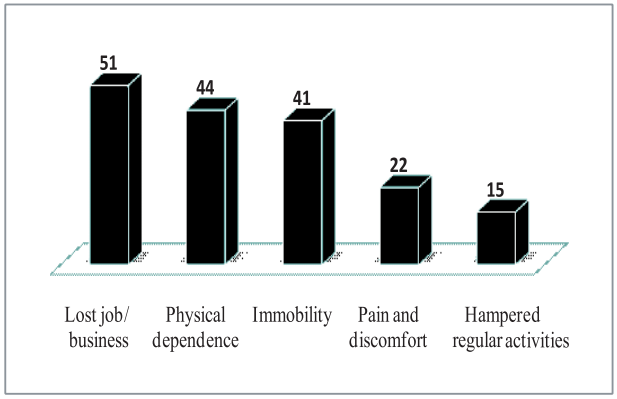


Fig 2. Physical disability with neurological complications in leprosy patients (some patients had multiple complications)

## Discussion

This study showed that males were affected more than females. This finding is similar to what have been found worldwide.[8] It appeared in this study that the age group 18–30 years is affected most commonly; this is similar to finding in another study.[9] This group being the most active component of the community highlights the need for early detection and treatment of the disease. The prevalence was found decreased (3.5%) in the age group >60 years.

In our study most of the patients had no family history of leprosy, this is similar to a study done in Ethiopia[10] and it differs from what was mentioned in the study done in Nepal where positive family history was found in up to 50% cases.[11] We assume that family history is very important because proximity to leprosy patients is an important determinant of transmission. Considerable number of our patients had no sensory impairment over skin lesions, this may be explained by the fact that sensory impairment over skin lesions is an uncommon and a late feature of the MB form of the disease. Numbness and weakness of the limbs (77.14%, 31.43%) were the most common neurological symptoms similar to what was mentioned elsewhere.[12] This is because leprosy affects peripheral nerves leading to sensory disturbance and weakness in addition to destruction of bones. Lower motor neuron facial weakness and trigeminal nerve involvement were found, which is similar to what was reported earlier.[13]

Olfactory and auditory nerves involvement was found in a few cases in this study. It is less than what was mentioned in a study done in Nepal.[14] Examination of

upper and lower limbs revealed that wasting, upper limb weakness and sensory disturbance were the commonest signs. In upper limbs, half of the patients (50.9%) had some degree of wasting. Motor dysfunction was predominant in the upper limb, but this is not similar to the study done in Nigeria[9] and Canada.[15] In the lower limbs, sensory nerve dysfunction with stocks pattern was the commonest sensory dysfunction detected in majority (56.4%) cases. This finding is similar to that in the study done by Boggild et al.[15] From previous studies it seems that our patients were more affected neurologically. This can be explained by delayed presentation of our patients and by the fact that most of our patients had MB form of leprosy. Ulnar nerve was found enlarged in maximum number of cases followed by the great auricular nerve and radial cutaneous nerve. This is slightly different from what was mentioned in the literature.[16]

Finally, in this study neurological involvement was found associated with severe disability. Severe complications and permanent disabilities can be reduced by early diagnosis and management. Tribal community people should be screened regularly for leprosy and health care personnel including doctors should be trained to make them aware of the different neurological presentations of this disabling disease.

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