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Investigating a Possible Linkage of Working with Migrant Workers and New Leprosy Cases among Indigenous Populations of Shimla, Himachal Pradesh, India

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This study was initiated in 2015, when an association of occurrence of leprosy in a rich apple orchard owner and his working with migrant workers from leprosy endemic state was observed. Further 21/27 (more than 70%) cases in Shimla districts were contributed by migrant workers during 2016-17 indicating the potential risk of spread to local population. We started an investigation of all new indigenous cases for the year 2015 of district Shimla and tracked their history of contact with any migrant labourers. Indirect correlation was found in overall decrease in leprosy cases among migrants associated with decrease in indigenous leprosy cases as well. The migrants carrying leprosy infection may be spreading it as infected droplets into the air and into the orchard soil and other fomites through exhalation of bacilli and also while blowing their noses in open air and in temporary sheds/rooms where migrant workers/ labourers and owners work together for apple grading. Sharing of temporary airspaces and fomites need to be investigated by classical epidemiological approaches as well as newer molecular technologies for studying such transmission and evidence based effective measures should be considered and taken to protect the population in leprosy free or low endemic settings such as in Himachal Pradesh. There is need to educate locals regarding hidden nature of leprosy infection that can spread from unsuspecting carrier migrants from leprosy endemic states of India and Nepal which is still an leprosy endemic country. Migrants from leprosy endemic districts need to be screened by an appropriate strategy and treated with MDT to effectively control leprosy spread. For that purpose innovative methods of screening, diagnosis and treatment of leprosy among migrant population, understanding the dynamics of such possible mode of transmission by molecular technology as well as awareness generation in the local population should be given due importance for effective control of leprosy in India.

Key Words : Leprosy Carrier, Sharing Airspaces, Fomites, New Leprosy Case, Droplet Infection

Introduction

India continues to account for 60% of new cases reported globally despite all efforts to control the disease (Rao & Suneetha 2018). India has recently launched "Sparsh Leprosy Elimination Campaign

(SLEC)" that focuses on Leprosy Case Detection Campaigns and minimizing disability due to leprosy. Following WHO guidelines (2018), it has been decided to launch Post Exposure Prophylaxis nationwide for contacts of all existing cases

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detected from October 2, 2018 by giving a single dose of Rifampicin. Village level Accredited Social Health Worker (ASHA) are already incentivized for identifying, reporting and helping complete treatment of any leprosy case. Data from Government of India for the year 2016-2017 show that a total of 135,485 new cases were detected during the year 2016-17 without a significant decline in new cases since the last decade since 2005-06. Detailed information on new leprosy cases detected during 2016-17 shows the proportion of Multi Bacillary (MB) cases as 49.57%, Females (39.17%), Child (8.7%), Grade II Deformity (3.87%), ST cases (18.80%) and SC cases (18.78%) (NLEP Report 2016-17). Highly endemic states like Odisha, Bihar, Chattisgarh have reported a Prevalence Rate (PR) > 1/10,000 population, as on 31st March 2017. Proportion of Child cases was more than 10% of new case detected in 10 States/UTs which shows that the leprosy infection is being detected in late stages and is infecting the children hence points towards urgent need to focus on leprosy control campaigns. 128 of 682 districts reported with PR > 1/10000 population. Number of new cases detected in Himachal during the year 2016-17 were just 146 out of which 27 were detected from Shimla district alone and only 6 were indigenous cases. We need to study various aspects of leprosy infection among new cases and take appropriate measure to stop leprosy spreading to healthy populations. For this a district level analysis of data can play an important role to contain leprosy by identifying the factors responsible for leprosy spread.

Himachal Pradesh in India is highly literate state with very good health indices and very low endemicity for leprosy that is mostly detected among migrant labourers that has been observed by us in the data from Shimla. The present study was initiated in 2015, when a rich apple orchardist

reported a numb patch on his left hand. A detailed history was taken and it was found that he used to spend 3-4 hours daily, close door, for two months every year with migrant labourers from leprosy endemic Nepal for grading and packing of apples. Nepal is the country with the seventh highest number of new leprosy cases diagnosed each year. Every year, we have high numbers of migrants getting diagnosed with Leprosy in Shimla and few indigenous persons (Data from Shimla). The migrants come to Shimla to work in apple orchards and live in make shift tents / houses. Mostly same group of migrants join the locals every year for apple crop harvesting that may be resulting in their acting as source of infection with same group of people every year. We decided to investigate all new indigenous cases prospectively for the year 2016 (April 2016-March 2017) of district Shimla and tracked their history of contact with any migrant workers.

Materials and Methods

We line listed all the new cases that presented to our hospital, DDU Hospital, Shimla in Himachal Pradesh and segregated them as immigrants/migrants from out of state called Outside Project Area (OPA) mostly from Nepal and Bihar and indigenous patients from Shimla district termed as Inside Project Area (IPA) for the year 2016. To carry out the study, we took ethical clearance from Institutional Ethics Committee (IEC) of J.P. University, Waknaghat in Himachal Pradesh wide letter No. IEC/project no - 28 - 2015 Dated 27-11-2015. All the six IPA patients were given a semi-structured questionnaire and they were further interviewed when they came to the office of District Leprosy Officer (DLO) Shimla for their monthly stock of medicine and follow ups.

The data for the year 2016 (April 2016 to March 2017) for the state of Himachal Pradesh was also analysed to see the trends and the data for the Shimla district for subsequent years was analysed

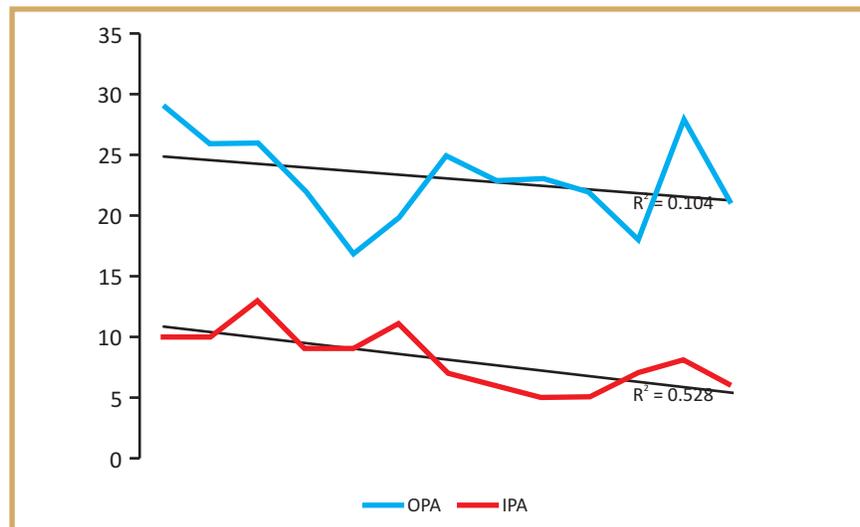


Fig 1 : Yearly trends of Leprosy cases detected Shimla District Himachal Pradesh showing decline in Leprosy in migratory population - OPA and indigenous leprosy cases - IPA.

to assess the correlation of leprosy cases among migratory labourers and indigenous population. Data was analysed using Microsoft Excel Software.

Results

Analysis of semi structured questionnaire and interviews revealed that there is a co-relation of migrant labour and the new indigenous leprosy cases as either they were employed by the affected persons or temporarily engaged for petty agriculture work by the apple orchardists in the village. The main variable is stay of the migratory labour that is on average 6 months every year with healthy family in a nearby hut. The average duration of contact with healthy population later found affected with leprosy was 3-4 hours daily, close door, for 2 months every year, rest of contact is open air while working on apple farms of an average 4 months.

Only one patient each in 2015-2016 and 2016-2017 had a definite link working with affected

migrant, in rest, migrants are around their area but no direct link could be established and may require genetic tracing.

All symptomatic migrants came for treatment and were documented but no contact tracing could be done for the family members due to limited staff deployed for NLEP in the office of District Leprosy Officer (DLO). The demographic data with the District Leprosy Officer show that 90% 19/21 of these immigrants/migrants were from leprosy endemic Nepal and others are from endemic states of India like Bihar and Chhattisgarh with few from Uttar Pradesh and Jharkhand.

Table 1 shows 13 year trends of Leprosy cases in Shimla District of Himachal Pradesh showing decline in Leprosy in migratory population is having corresponding decline in indigenous leprosy cases as both trend lines go down for the years 2004-2005 to 2015-2017 for which segregated data was available at DLO office. The most affected blocks are of "Apple Belt" having

Table 1 : Yearly Pattern of Leprosy cases Shimla District Himachal Pradesh

YEAR	Total Leprosy Cases	OPA	IPA
2004-05	39	29	10
2005-06	36	26	10
2006-07	39	26	13
2007-08	31	22	9
2008-09	26	17	9
2009-10	31	20	11
2010-11	32	25	7
2011-12	29	23	6
2012-13	28	23	5
2013-14	27	22	5
2014-15	25	18	7
2015-16	36	28	8
2016-17	27	21	6

large number of migratory labour are Mashobra, Kotkhai, Tikker and Nerwa. All block show a mixing of OPA and IPA.

Since same population of workers come to the home of locals to work for apple orchards or they stay in temporary huts all year after year, therefore, possibility of continuous trend of infection among the OPA and IPA needs to be examined.

Discussion

Our study shows a possible link between occurrence of leprosy in local people who worked with migrant workers from leprosy endemic country like Nepal as well as those from leprosy endemic states of India. Further more than 70% patients contributed by migrant workers in 2016-17 in this area also indicate the chances of potential spread of leprosy infection to local people. Such possibility should be investigated in depth by well designed studies and also using DNA finger techniques available to trace the sources of infection and appropriate active

detection and treatment in these migrant workers as well as those exposed to them should be part of such strategy. Shedding of *M. leprae* from leprosy cases during exhalation of breath as well as unhygienic practices of the migratory workers to blow nose and through away nasal secretions in the apple orchards or clean their hands with apple trees (As seen by us on spot visit) may be source of infection to the local indigenous farm owners. Lepra Bacillus can survive in the soil for many days is reported by many studies (Desikan & Sreevatsa 1995). The infected soil may transmit the infection to the healthy persons even through intact skin/Hair follicles (Girdhar 2005). Another study also shows that *M. leprae* can remain viable long-term in environmentally ubiquitous free-living amoebae (FLA) and retain virulence contributing to the higher-than-expected rate of leprosy transmission despite a significant decrease in human reservoirs due to Multi Drug Treatment, MDT (Wheat et al 2014).

The subclinical stage of leprosy having potential

to be infectious to others by nasal secretions is described in literature (Araujo et al 2012). Practical Medical Microbiology (Collee et al 2008) emphasizes that "smears from nasal mucosa should always be made, as these may be positive when skin lesion are not clinically apparent". This situation indicates that carriers may also be spreading infection while they are not clinically diagnosed as leprosy patients as most of the migrants appear to be healthy but may be carrying the disease. We know that bacterial load in lepromatous leprosy (which is a small proportion of MB cases) is much higher (i.e. in billions or even in trillions) than the remaining cases. If one case of lepromatous leprosy has remained undetected-untreated, it will be source of infection for many years and transmission of leprosy will continue, new cases will keep emerging for years. The first reason for continuing treatment beyond the first doses of Rifampin is to prevent the risk of selection of Rifampin-resistant bacilli. The second reason is that after very short-term multidrug therapy in patients suffering from multibacillary leprosy in Bamako, it was found that the shorter the duration of antibiotic administration, the earlier the relapses occurred. It is difficult to reduce the duration of the multidrug therapy recommended by the WHO. It is based on the combination of the three best-tolerated antibiotics, Rifampin, Dapsone, and Clofazimine, of which only Rifampin is highly bactericidal (Grosset 2005). Number of bacteria killed by treating 1000 PB cases may be 1000×10^4 i.e. 100,000,000 as compared to 5 case of untreated lepromatous leprosy ($5 \times 10^{10} = 500,000,000,000$) and requires an aggressive approach to deal with highly infectious Lepromatous Leprosy. Skin smear microscopy is used to detect alcohol-acid resistant bacilli (AARB) in skin smears collected from standard sites (skin lesions, ear lobes, elbows) but sensitivity is low in the

paucibacillary group (PB), in which smear is often negative, with a limit of microscopy detection of 10^4 AARB bacilli per gram of tissue (Lastoria & Abreu 2014). We in our district Shimla have successfully used fluorescent microscopes available for Revised National TB Control Programme (RNTCP) Laboratory, for identification of Leprosy Bacillus using Fluorescent Auramine O stain (Girma et al 2018) and that can be done in other Designated Microscopic Centers of RNTCP in India spreading across even rural blocks where other lab facilities to stain Lepra Bacillus are not available.

A randomized control study has shown that chemoprophylaxis with single dose Rifampicin (SDR) has a 57% overall risk reduction in preventing the development of leprosy for household contacts during the first 2 years after its administration (Feenstra et al 2012). The chemoprophylaxis may be a better option than looking for skin lesions of contacts and needs to be tried in migratory labourers from high endemic zones like Nepal and Bihar.

Recent descriptive studies have indicated that increased age, poor sanitary and socioeconomic conditions, lower level of education, and food-insecurity are risk markers for leprosy (Pescarini et al 2018) but this analysis did not include factor of migration from high endemic areas to low endemic areas and its impact on healthy populations of low endemic areas.

Another study points that state control programmes should consider monitoring past five year residence among those newly diagnosed with leprosy to identify intra- and inter-state migration flow. This may provide early warning systems for localized disease control in areas yet to be identified as high-risk areas (Murto et al 2013).

Conclusions and way forward : Our study demonstrates that there appears to be cor-

relation between working with infected migrant populations and emergence of new cases among healthy indigenous population of Shimla district, Himachal Pradesh. For the last decade the new cases of leprosy in India have stabilized around 135,000 new cases every year and are not coming down despite all out efforts. In Himachal Pradesh they have stabilized around 150 new cases every year and in Shimla district at around 30 new cases per year. This stabilization of new cases detected over the last decade requires to be broken with new innovations and strategies to control the transmission of infection to the healthy populations and to prevent a new crop of infection every year in India. We need to focus on high endemic districts of India like Bihar, Odisha and Chattisgarh and need to track the movements of migratory labourers from these high endemic districts as well as those from Nepal so that they could be diagnosed early and treated at their working places in Himachal Pradesh. Also new treatment strategies need to be considered such as chemoprophylaxis and immunoprophylaxis. *Mycobacterium indicus pranii* (MIP), also earlier known as *Mycobacterium w* (Mw) based Leprosy vaccine developed in India is available as immunomodulator "Immunovac" and is being piloted in some districts of Bihar and Gujarat. Clofazimine should be added to the regimen of drugs used to treat paucibacillary leprosy (Katoch et al 1999, Bhaumik 2013, Indian Council of Medical Research 2014, WHO 2018). The clinicians in our hospital are using Immuvac for better outcomes in MB leprosy cases as this adjunct immunotherapy to standard chemotherapy has been observed to enhance bacterial killing and reducing bacterial load more effectively (De Sarkar et al 2001, Katoch et al 2004).

The migrant workers coming from high endemic Nepal, Chattisgarh and Bihar need to be screened to detect any leprosy case early and treated.

Chemoprophylaxis / Immunoprophylaxis or both to those healthy contacts should be provided who have a history of having a leprosy case in the family or may be to all migrants coming from leprosy endemic states/districts of Nepal and India. New methods like immunochromatographic test (Paula Vaz Cardoso et al 2013) suitable for large scale screening of people such as migrants from endemic states as well as other suspects should be studied as a possible strategy to know their usefulness in identifying carriers reliably at an early stage which could be treated before they become a source of infection to healthy populations of non endemic states in India like that of Himachal Pradesh.

Recommendation : Our study sparked by the observation of a rich orchardist getting infected with leprosy possibly through an immigrant worker later diagnosed as having leprosy is just a pointer to look for linkages of migration within India and spread of leprosy to healthy indigenous populations. A large scale study(ies) between two states say one with high endemicity for leprosy and one having labourers from this state to low endemic state need to be taken up to further establish the linkage of migration and leprosy by using robust epidemiological & molecular tools; and to take appropriate steps to control this mode of spread of leprosy.

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