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Are children safe from complications of leprosy? A study from North Kerala

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ABSTRACT

Objectives: The aims of the study were (1) to document the demography and clinical profile of patients with leprosy at a tertiary referral center from 2009 to 2018. (2) To compare the disease manifestation in children aged 12 years/below and the same in patients above 12 years.

Materials and Methods: Case records of all patients diagnosed to have leprosy as per the World Health Organization cardinal criteria at our tertiary referral center from 2009 to 2018 were included in this study. The findings recorded in those aged 12 years/below were compared with those above 12 years using Pearson's Chi-square test.

Results: A total of 705 patients who attended our institution during the 10 year period were diagnosed to have leprosy. Six hundred and sixty-four (94.2%) were above 12 years of age and 41 patients (5.8%) were aged 12 years or below. Lepromatous spectrum cases, pure neuritic cases, Grade 2 disability, and lepra reactions were not documented in any of the patients aged 12 years or below which were contrary to the observations in those above 12 years. The differences were found to be statistically significant.

Limitations: Retrospective design and small number of childhood cases were the main limitations of the study.

Conclusion: Clinical presentation of leprosy in children differs from that in adults. Detection of disease in childhood offers an opportunity to cure the disease with less risk of developing some of the important disease and therapy-related complications.

Keywords: Clinical profile, Leprosy, Children

INTRODUCTION

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. *M. leprae* is a pathogen of low virulence. It does not produce any toxins either. Susceptibility to *M. leprae* and the clinical pattern of the disease are determined by the immune response of the exposed individual to the organism.

Granuloma formation is the characteristic histopathology feature of leprosy except in indeterminate cases. Affected host tissues such as peripheral nerves and skin suffer damage as a result of the space-occupying nature of granulomas.

Childhood leprosy assumes significance since the number of childhood cases in an area denotes the rate of horizontal transmission of *M. leprae*. A significant percentage of childhood cases point

to the existence of disease in the community as a major public health problem. Another noteworthy aspect of childhood leprosy is the occurrence of infection in children with immature immune system. Hence, the disease manifestation could vary from that observed in adults.

In this 10 year retrospective study, we have aimed to compare the clinical manifestation of leprosy in children aged 12 years and below with that of patients aged above 12 years.

MATERIALS AND METHODS

After getting clearance from the Institutional Ethics Committee, case records of leprosy cases diagnosed on the basis of the World Health Organization (WHO) cardinal criteria at our center from 2009 to 2018 were reviewed.[1] Records having insufficient data were excluded from this study.

The clinical features, skin smear results, histopathology findings (as per departmental policy all cases of leprosy diagnosed as per the WHO criteria are advised to undergo biopsy from representative skin lesion) were collected using a pre-set proforma. The patients were classified into different groups of spectra based on clinical features, skin smear studies, and histopathology findings. Treatment received by the patient was noted (patients received multibacillary (MB) or paucibacillary (PB) treatment as per the WHO guidelines).[1] Grade 1 and Grade 2 disability at the time of presentation were documented.[1] Lepra reactions whenever present were noted. When a patient in the borderline spectrum of leprosy manifested acute onset of erythema and edema of skin lesions with or without neuritis and edema of the hands, feet, and face, Type 1 lepra reaction (T1R) was diagnosed. Type 2 lepra reaction (T2R) was considered when a borderline lepromatous (BL) or lepromatous leprosy (LL) patient developed crops of tender subcutaneous skin lesions with or without accompanying neuritis, iritis, arthritis, orchitis, dactylitis, lymphadenopathy, edema, and fever.[2]

The data were entered in Microsoft excel sheet and analyzed with SPSS for Windows, version 18.0. (SPSS Inc., Chicago, USA). The clinical features and disease characteristics in patients aged 12 years and below were compared with those above 12 years using Pearson's Chi-square test. $P < 0.05$ was considered as significant.

RESULTS

During the 10-year study period, 705 cases of leprosy were diagnosed at our center. Among them 41 were children aged 12 years or below, constituting 5.8% of total. Male to female ratio among those above 12 years was 2.3:1 (463 males and 201 females), whereas among children there were 21 males and 20 females (1.1:1). The disparity was found to be statistically significant [Table 1, $P = 0.01$]. Age of the affected ranged from 2 to 12 years among children and 13–78 years among those above 12 years.

Contact history was available in 29/705 older patients (4.1%) and in six of the 41 (14.6%) childhood cases. In both categories, the contacts were family members.

The majority of the affected belonged to the 10–12 year age group among children (23, 56.1%) followed by 6–10 year age group (15, 36.6%) and 2–5 year age group (3, 7.3%). Among those above 12 years, the most common age group affected was the 21–40 years (264, 39.8%), followed by 41–60 years (235, 35.4%), 13–20 years (86, 12.9%), and more than 60 years (79, 11.9%).

Borderline tuberculoid leprosy (BT) was the major spectrum among both groups [Table 2] (31/41 children, 75.6% and 395/664 among those above 12 years, 59.5%). The frequency of BT spectrum was higher in children, this was found to be statistically significant ($P = 0.04$). The absence of cases in lepromatous spectrum (BL and LL) among children was statistically significant ($P = 0.002$). The disparity noted in frequency of pure neuritic cases among children and those above 12 years was also statistically significant ($P = 0.009$).

Peripheral nerve enlargement was observed in 24 children (58.5%) and 645 (97.1%) of older individuals. This was also found to be of statistical significance ($P < 0.001$).

None of the children manifested Grade 2 disability at presentation; Grade 1 disability was documented in four children (9.8%). Three patients had sensory impairment of feet and one had sensory impairment of hands. Grades 1 and 2 disability at presentation were observed, respectively, in 362 (54.5%) and 196 (29.5%) of the 664 patients aged above 12 years. The disparity observed in Grade 1 and Grade 2 disability at presentation was again statistically significant with $P < 0.001$ in each instance [Table 1].

T1R and T2R were documented in 149 and 27 older cases, respectively. About 28% (149/532) of at risk patients manifested T1R (BT, BB, and BL and LL are considered at risk for T1R) and 20.6% (27/131) of at risk patients (BL and LL) developed T2R. None of the children had evidence of T1R or T2R. The association noted between age above 12 years and T1R was statistically significant with $P < 0.001$ [Table 1].

Among children 10 (24.4%) required MB and 31 (75.6%) required PB treatment. Five hundred and twenty-six (79.2%) of those above 12 years received MB and 138 (20.8%) needed PB treatment. This was found to be significant statistically [$P < 0.001$, Table 1].

DISCUSSION

There have been several studies in childhood leprosy from all around the world including India. Cutoff age for most of these studies varied from 14 to 19 years.[3-8] However, the

Table 1: Comparison of clinical profile and gender distribution of leprosy among pediatric age group and above.

Study subjects	Above 12 years	12 years and below	*P*-value
Gender distribution			
Males	463	21	0.01
Females	201	20	
Borderline tuberculoid group of disease	395/664	31/41	0.04
Borderline lepromatous and lepromatous leprosy groups of diseases	131/664	0/41	0.002
Pure neuritic leprosy	95/664	0/41	0.009
Grade 1 disability	362/664	4/41	<0.001
Grade 2 disability	196/664	0/41	<0.001
Type 1 lepra reaction	149/532	0/41	<0.001
Mutibacillary treatment	526/664	10/41	<0.001

Table 2: Distribution of cases in different groups of leprosy spectrum.

Study subjects	Indeterminate leprosy (%)	Pure neuritic leprosy (%)	Tuberculoid leprosy (%)	Borderline tuberculoid leprosy (%)	Mid borderline leprosy (%)	Borderline lepromatous leprosy (%)	Lepromatous leprosy (%)	Total (%)
Children aged 12 years or below	8 (19.5)	0 (0)	2 (4.9)	31 (75.6)	0 (0)	0 (0)	0 (0)	41 (100)
Study subjects above 12 years	16 (2.4)	95 (14.3)	21 (3.2)	395 (59.5)	6 (0.9)	59 (8.9)	72 (10.8)	664 (100)
Total	24 (3.4)	95 (13.5)	23 (3.3)	426 (60.4)	6 (0.9)	59 (8.4)	72 (10.2)	705 (100)

immune system of an adolescent reacts differently from that of a child below 12 years, which assumes importance in a disease like leprosy where disease manifestations depend on the host's immune response to invading pathogen.

Childhood cases contributing to 5.8% of the total leprosy caseload was less than that observed in many previous studies.[3-5] This could be due to adopting 12 years as the cutoff for the present study, whereas previous studies included patients up to 15–19 years under the category of childhood leprosy. The lack of significant predilection for male gender observed among childhood cases in this study was consistent with the observation of Babu *et al.*, but was discordant to many other studies that noted a male predilection.[4-8] This was also contrary to the findings in leprosy patients above 12 years who attended our center during the study period. No definite conclusion can be drawn from the lack of significant predilection noted for male gender among childhood leprosy cases in the current study due to the small sample size.

Possible family contact being identified in about 14% of childhood cases as documented by us was comparable to existing literature though a higher percentage was documented by Chaitra and Bhat.[6] A higher percentage (14%) of childhood cases having an affected family member in comparison to adults (4.1%) as observed in this study, underscores the vulnerability of children to infection and the importance of screening the contacts and family members of the patients.

The most common age group affected among children and those above 12 years documented in the study was consistent with existing data.[4,9] 10–12 years, being the most common age group affected among children could be attributed to the long incubation period of the disease.

BT being the common spectrum in the affected, irrespective of age was consistent with previous studies, though some authors have recorded TT as the most common spectrum observed in childhood leprosy.[3-8] The absence of pure neuritic and lepromatous cases among those aged 12 years or below was comparable to literature that suggested such manifestations to be rare in childhood leprosy.[4] The absence of pure neuritic and lepromatous cases in this study, rather than the paucity of the same noted by others in childhood leprosy may be a reflection of limiting the study to those below 12 years of age.

The disparity noted regarding frequency of lepromatous cases among children and those above 12 years could be due to the possible shorter duration of disease in children. Leprosy with its asymptomatic nature is often missed in early stages. The considerable delay occurs between actual onset of disease and the time when the lesions are first noted by the patient. Disease like leprosy having an incubation period of 3–7 years is more likely to be of shorter duration when detected in children below 12 years. Another reason could be the effect of universal Bacille Calmette–Guerin (BCG) vaccination which is considered to have a protective efficacy of around

50%. The protective efficacy of BCG is proposed to decline as age advances.[4] This could be the reason for most of the children being able to contain the disease to the tuberculoid spectrum and requiring only PB treatment compared to their older counterparts despite the immaturity of immune system.

Pure neuritic leprosy is diagnosed by the combination of enlarged peripheral nerves and sensory and/or motor function impairment along the supply of nerves. Nerve function impairment results from the pressure effect of granuloma on nerve fibers. It is suggested that children are unable to mount granulomatous response strong enough to cause enough damage to produce nerve function impairment which could explain the absence of pure neuritic cases in children.[4] This could be the reason for the less frequency of nerve thickening observed among childhood cases (58.5%) in comparison to those above 12 years (97.1%).

None of the patients in pediatric age group manifesting type 2 reaction was as expected since none of the children presented with leprosy types that are considered at risk to develop T2R.

Grade 1 disability noted in four of the children highlights the importance of early identification of sensory impairment and educating the affected, on lifestyle modification so as to prevent progression to Grade 2 disability and deformity. The extent of granulomatous response mounted by host determines the damage suffered as part of disease. Stronger immune response to *M. leprae* in older patients leading to higher risk of lepra reactions and nerve function impairment that, in turn, resulting in higher frequency of Grade 1 and Grade disability was expected. In a previous study by us that evaluated childhood cases (age below 15 years) from 2003 to 2012, all those who developed Grade 2 disability belonged to the age group of 13–15 years.[3] The absence of T1R observed in childhood cases despite majority manifesting BT could also be attributed to the immaturity of their immune system.

Limitation

Retrospective study design and the limited number of childhood cases were limitations.

CONCLUSION

Leprosy in children differs from adult cases in the clinical profile. The disease is more likely to present in tuberculoid spectrum. Nerve function impairment, disease associated disability, and lepra reactions which are often precipitated by multidrug therapy in older individual are less common features in children. Detection of disease in childhood offers an opportunity to cure the disease with less risk of developing some of the important disease and therapy-related complications. Moreover, the majority of cases being detected in school going children which is consistent with the incubation period of the disease points to the importance of conducting regular school surveys in early detection of disease.

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Declaration of patient consent

Patients consent not required as it is a retrospective study and patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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