

Clinico-radiological Correlation of Bone Changes in Leprosy Patients Presenting with Disabilities/Deformities

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Leprosy is a medical- social disease, it is associated with stigma in the society due to the resulting deformities in some persons. Although stigma has decreased after the widespread use of MDT, some disabilities do occur which are mostly due to late initiation of treatment and inappropriate care. Besides the nerve and skin involvement bone changes have been reported to be common in leprosy. These bony changes need to be understood in the present MDT era specially in the context of clinical spectrum and duration of disease/ deformities. Fifty clinically diagnosed and histologically classified leprosy patients with deformities/ disabilities of either hands/feet/ face who attended the OPD of Department of Dermatology, Venereology and Leprosy, Government Medical College, Amritsar were examined and evaluated in the study. Radiological examination of hands, feet and skull was done in each case and the bone changes in hands and feet; and skull and paranasal sinus changes were correlated with clinical parameters. Bone changes were observed in 90% of cases radiologically. Specific bone changes in hands and feet, non-specific bone changes in hands, feet, skull and paranasal sinuses were seen in 66%, 82% and 32% of cases respectively. Common specific bone changes in hands and feet observed were primary periostitis (14%), honey combing (46%), bone cyst (36%), thinning and irregularity of cortex (28%) and area of bone destruction (20%); Among the non-specific bone changes observed were contracted fingers/claw hands/claw toes (64%) and absorption of terminal phalanges (40%). The maxillary sinus, and paranasal sinus changes were the most common radiological findings observed in skull. The study of the radiological changes may help the clinicians to understand the gravity of the situation and undertake steps for timely prevention of permanent loss of function and the occurrence of deformities and disabilities.

Key words : Leprosy, Deformities, Radiological changes

Introduction

Leprosy is a chronic granulomatous disease caused by *Mycobacterium leprae*, an acid fast rod

shaped bacillus which was discovered by Armauer Hansen in 1873 in Norway. The disease mainly affects the peripheral nerves and the skin and

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sometimes other tissues, notably the eyes, the mucosa of the upper respiratory tract, muscles, bones and testes. Clinical spectrum of leprosy can vary from the presence of an insignificant area of hypopigmented skin that heals spontaneously, to widespread involvement of skin, damage to peripheral nerves, eyes, bones, muscles and other tissues with the development of deformities and disability. The whole spectrum from the Indeterminate, Tuberculoid to the Lepromatous disease has been divided into five types based on clinical, bacteriological, histological and immunological features (Ridley and Jopling 1966, IAL classification 1982). Pure Neuritic type is seen especially in India (IAL classification 1982). The disease itself is not directly responsible for most of the deformities. Leprosy characteristically results in extensive nerve damage leading to varying loss of sensation of touch, temperature and pain and so the patient unknowingly damages and deform himself/herself. Deformity is defined as alteration in the form, shape or appearance of a part of the body, whereas disability is deterioration in the ability or capacity of an individual (Dharmendra 1978). Deformities of limbs in leprosy are of two types, primary and secondary. Primary deformities are directly the results of the invasion of the tissues by *M. leprae* or the result of reaction of the body to the infection. The most important primary disability is the loss of nerves and nerve endings resulting in loss of sensation, damage to the part, most often repeatedly, paralysis and deformities. The loss of sensation makes the patient liable to injuries because of continuous use of insensitive hands and feet which are repeatedly injured/wounded and may also be secondarily infected. This results in ulceration and absorption of digits, amputations which lead to severe disability and is a cause of stigma to the patient and the society. Brand (1966) emphasized on the impact of paralysis of nerves and reported that nonspecific

infection and trauma are the reasons for bone resorption in 98% of cases (MacMoran and Brand 1987).

Disabilities and deformities in leprosy patients are not an inevitable result of the disease except in few, such as collapse of the nose or loss of eyebrows in untreated advanced lepromatous leprosy. The majority of disabilities and deformities are attributable to peripheral nerve damage which occurs in two particular phases of the disease, namely in the long untreated patients and during the course of both Type I and Typell lepra reactions (Pearson and Ross 1975). Early diagnosis, regular and adequate treatment, and early recognition of decreasing nerve function are of utmost importance for prevention and possible reversal of nerve damage.

M. leprae has a predilection for infecting tissues in the cooler areas of the body, consequently the characteristic bone lesions are seen in the acral parts of the body. Bone changes attributed to leprosy may be divided into two groups, 'specific' and 'non-specific' in origin. Specific bone lesions are the direct effect of *M. leprae* invasion (leprosy osteitis) whereas non specific lesions are the result of trauma and infection of the tissues denervated by leprosy infection (Paterson 1961, Lechat 1962).

With the widespread use of multi-drug therapy (MDT), clinical profile of disease is changing. For providing proper care we need to study the profile of disease in different settings specially the extent of involvement of different organs. The main aim of this study was to evaluate the pattern of bone changes in leprosy patients with disabilities/deformities of hands, feet and face and to correlate the clinical findings and duration of disease/deformities with radiological changes in them.

Materials and Methods

Fifty clinically diagnosed leprosy patients with deformities/disabilities of either hands/feet and/or face irrespective of their age, sex, occupation and treatment status were selected for this study. These patients were attending the leprosy clinic of Skin and STD Department, Guru Nanak Dev Hospital/Govt. Medical College, Amritsar. Ethical clearance for the study protocol was obtained from the Institutional Ethical Committee of the Medical College, Amritsar. An informed consent was obtained from all the patients included in the study.

Clinical evaluation was done with particular reference to the age, sex, occupation, duration and type of leprosy, duration of deformity, lepra reaction, trophic ulcers and other secondary changes. Routine investigations including slit skin smear and skin biopsy were done in each case for were done in each case which included anteroposterior and lateral views of the hands, feet and skull and Water's view for ascertaining the involvement of paranasal sinuses.

Disability index (DI), which indicates severity of disabilities/deformities was calculated using the formula proposed by Bechelli and Dominguez (1971). DI is related to the maximum grades of disabilities. The grades of deformities/disabilities of right and left sides of hands, feet and face were

added and it was divided by the number of sites studied i.e. 6 (Table 1). Disability index was calculated in these leprosy patients having disabilities/deformities according to WHO disability grading system (WHO 1970). Various radiological changes in hands, feet and skull were then correlated with the clinical parameters such as age, sex, occupation, type of leprosy, duration of disease, deformity, disability index, reaction and treatment status.

Results

Important findings of the present study are summarized in Tables 1 to 8 and illustrated in Figures 1 to 6. The mean age of the patients included, was 41.7 years (range from 10-90 years). Genderwise distribution of cases was 34 males and 16 females Majority of patients



Fig 1 : Types of injuries in the anaesthetic hands and feet

Table 1 : Method of Calculation of Disability Index [DI] (Bechelli and Dominoguez 1971)

Sign	Hand		Foot		Eye	Eye	
	Right	Left	Right	Left		Right	Left
Trophic ulcer	Max 2; Minimum zero		Max 2; Minimum zero		Conjunctivitis/ keratitis	Max 2; Minimum zero	
Mobile claw/foot drop					Lagophthalmos		
Fixed deformity, absorption, stiff joints	Min 2: Max 3		Min 2: Max 3		Iritis/Iridocyclitis/ severe loss of vision	Min 2: Max 3	
Total							



Fig 2 : Skiagram of left hand with absorption of middle & distal phalanges of index, middle and ring finger; eccentric absorption of corresponding proximal phalanges; clawing of little finger and thumb; Right hand skiagram shows absorption of middle and distal phalanges of middle and little finger; eccentric absorption of proximal phalanx of middle finger; arthrodesis of proximal and distal interphalangeal joint of ring finger; concentric and eccentric absorption of distal and middle phalanges of ring finger.



Fig 3 : Showing left ulnar claw hand



Fig 4 : Ray showing bony changes in hand with clawing of left little finger

31 (62%) were in the age group of 20-59 years. Profession wise predominant among them were labourers (24 i.e. 48%;) followed by housewives (14; i.e. 28%) 5 office workers (10%), 3 patients were students, 3 farmers (6% each) and one businessman (2%). A good number of patients (23; 46%) were having disease from the last 1-5 years while the rest (27; 54%) were suffering from the diseases for more than 5 years. Forty three patients had MB disease (LL-21, BL-7, BB-3, Polyneuritic 12) while rest had BT disease (BT-7). No case of tuberculoid type (TT) was seen in the study group.

The duration of presence of deformities/ disabilities in these leprosy patients was for < 1 year in 14 patients (28%); it ranged between

1-5 years in 20 (40%) patients followed by more than 5 years in 16 (32%) of cases. Majority of patients 36 (72%) were receiving regular treatment for a variable period of time. Fourteen (28%) cases were untreated and presented with deformities. Majority of patients (84%) presented with weakness, followed by anaesthesia of hands and feet in 78% of cases and claw hands and toes in 74% of cases (Table 5). One case was also having Type I lepra reaction and 4 cases had Type II lepra reaction. A substantial proportion of patients (i.e. 21; 42%) had a disability index between 0.16 to 0.5, one (2%) case had a disability index ranging between 1.66-2.0, and the rest had between >0.5 to 1.66 (28; 56%).



Fig 5 : Showing depressed bridge of nose in lepromatous leprosy



Fig 6 : Showing diffuse infiltration of face, loss of eye brows, destruction of nasal septum

Table 2 : Specific bone changes observed radiologically in hands and feet

Specific bone changes in hands and feet	No. of cases showing radiological changes				In percentage
	Hands alone	Feet alone	Both hands and feet	Total number of cases	
Primary periostitis	2	5	-	7	14.0
Honey combing	4	8	11	23	46.0
Bone cyst	4	11	3	18	36.0
Enlargement of nutrient foramen	2	1	-	3	6.0
Thinning and irregularity of cortex	4	4	6	14	28.0
Concentric cortical erosion	1	4	-	5	10.0
Area of bone destruction	2	7	1	10	20.0
Sub-articular erosion	0	1	2	3	6.0
Sclerosis	5	3	-	8	16.0
Any other	-	-	-	-	-

The overall prevalence of bone changes in these patients was 90% (45/50 patients). Several

patients had more than one type of bone changes, as well they involved multiple limbs

Table 3 : The non specific bone changes seen radiologically in hands and feet

Non-specific bone changes in hands and feet	No. of cases showing radiological changes				In percentage
	Hands alone	Feet alone	Both hands and feet	Total number of cases	
Absorption of the following					
o Terminal phalanges	5	5	10	20	40.0
o Middle phalanges	3	10	3	16	32.0
o Proximal phalanges	-	8	1	9	18.0
o Metacarpals	-	-	-	-	-
o Metatarsals	-	1	-	1	2.0
Soft tissue changes	-	7	1	8	16.0
Concentric absorption	4	9	3	16	32.0
Contracted fingers / claw hand/claw toes	24	3	5	32	64.0
Tuft erosion	3	7	6	16	32.0
Arthritis	5	3	1	9	18.0
Subluxation and/or dislocation	5	7	4	16	32.0
Cupping of joints	-	8	3	11	22.0
Fractures	-	2	-	2	4.0
Secondary periostitis	1	3	-	4	8.0
Osteomyelitis	-	3	-	3	6.0
Disintegration of tarsal bones	-	4	-	4	8.0
Eccentric absorption	1	6	2	9	18.0
Others	-	16	-	16	32.0

Table 4 : Bony changes detected radiologically in skull and paranasal sinuses

	Right	Left
Maxillary antrum		
• Diffuse opacity	4	5
• Local mucosal thickening	5	4
• Generalized mucosal thickening	9	6
Ethmoidal sinus sinus	1	-
Frontal sinus	-	-
Atrophy/loss of anterior nasal spine	-	-
Atrophy/loss of alveolar process of maxilla	-	-

Table 5 : Correlation of bone changes detected radiologically with clinical features

Clinical features	Number of patients with clinical features	No. of patients with signs who have					
		Specific bone changes in hands and feet		Non specific changes in hands and feet		Skull and paranasal sinus changes	
		Total	Percentage	Total	Percentage	Total	Percentage
Anaesthesia of limbs	39	29	74.3	32	82.1	14	35.9
Weakness	42	29	69.0	36	85.7	15	35.7
Trophic ulcer	23	19	82.6	21	91.3	7	30.4
Joint pain	15	9	60.0	10	66.6	4	26.6
Swelling of joints	20	15	75.0	18	90.0	6	30.0
Claw hands/toes	37	23	62.2	32	86.5	12	32.4
Wrist drop/ foot drop	2	2	100.0	2	100.0	-	-
Absorption of fingers or toes	21	17	80.1	20	95.2	8	38.1
Amputation of fingers/toes	10	10	100.0	10	100.0	4	40.0
Lepra reaction							
Type - I	1	1	100.0	1	100.0	1	100.0
Type - II	4	2	50.0	3	75.0	1	25.0

(Table 2). These radiological changes were further sub-grouped into *specific* and *non-specific* bone changes in hands, feet; skull and paranasal sinus.

Specific bone changes in hands and feet : Specific bone changes in hands and feet were seen in 66% of patients. Various changes with their frequencies are shown in Table 2.

Non specific bone changes in hands and feet : Non specific bone changes in anaesthetic hands and feet (Fig 1), claw hand (3) are shown in Fig 2 and 4 respectively, these are also summarized in Table 3. Such changes were seen in 82% of patients. Several of patients with specific bone changes also had bone changes attributable to

non-specific reasons and multiple limbs were involved in these non specific changes. The individual changes with their frequencies are shown in Table 3.

Skull and paranasal sinus changes : Among the bone changes in the skull, majority of bone changes were seen in maxillary antrum (Fig. 5) followed by ethmoidal sinus in one case only. Clinically extensive facial and nasal involvement was visible in some of such cases (Fig. 6). Various changes with their frequencies are shown in (Table 4).

Clinico-radiological correlation

All the patients i.e. 100% showing specific bone changes in hands and feet and 46% who had

Table 6 : Comparison of frequency of various specific bone changes in hands and feet by various investigators with present study

S.No.	Specific bone changes in hands and feet	Paterson ¹⁸	Chhabriya et al ⁸	Thappa et al ²³	Choudhuri et al ⁹	Present study
1.	Bone cyst	2.8%	22.0%	10.5%	22.7%	36.0%
2.	Subarticular erosion	-	10.0%	10.5%	10.0%	6.0%
3.	Enlargement of nutrient foramens	1.5%	2.0%	5.3%	4.5%	6.0%
4.	Primary periostitis	-	4.0%	1.3%	28.2%	14.0%
5.	Concentric cortical erosion	0.2%	8.0%	1.3%	10.0%	10.0%
6.	Honeycombing	3.0%	6.0%	-	-	46.0%
7.	Thinning and irregularity of cortex	-	4.0%	-	-	28.0%
8.	Ill defined areas of bone destruction	1.0%	8.0%	-	-	20.0%
9.	Sclerosis with					
	• No deformity	2.6%	14.0%	-	-	16.0%
	• With deformity	1.6%	-	-	-	-
10.	Pseudocysts	5.0%	-	-	-	-
11.	Subarticular collapse	1.2%	-	-	-	-
12.	Cortical areas destroyed	0.7%	-	-	-	-

changes in skull and paranasal sinus changes were in the age group of more than 60 years. While 100% of patients in the age group of 0-19 years showed only non specific bone changes in hands and feet. There was no significant difference in specific bone changes and skull and paranasal sinus changes ($p > 0.05$) in the males as compared to females. The differences were significant in case of non-specific bone changes ($p < 0.05$), being more in women than in men. Occupation wise specific bone changes in hands and feet were seen in 100% cases of farmers while nonspecific bone changes in hands, feet, skull and paranasal sinuses was noted in them. These were seen in 100% of cases of students and businessmen. In the present study, the highest percentage i.e. 90% of patients showing specific and non specific bone changes in hands and feet belonged to LL

type of leprosy while highest percentage i.e. 42% of patients having skull and paranasal sinus changes were of the LL and BL types.

As summarised in Table 6, specific bone changes in hands and feet were seen in 100 % of patients with amputation of fingers/toes, wrist drop/foot drop and Type I lepra reaction; 82.6% with trophic ulcer; 80.1% with absorption of fingers/toes; 75% with swelling of joints; and 50% with Type II lepra reaction. Non-specific bone changes in hands and feet were seen in all cases with wrist drop/foot drop, amputation of fingers/toes and Type I reaction. Skull and paranasal sinus changes were seen in one case of Type I reaction 4/10 cases with amputation of fingers/toes, 8/21 cases with absorption of fingers or toes. Three out of four cases of Type II lepra reaction also showed this type of bone changes.

Table 7 : Comparison of frequency of various non specific bone changes in hands and feet by various investigators with present study

S.No.	Non-specific bone changes in hands and feet	Paterson ¹⁸	Chhabriya et al ⁸	Thappa et al ²³	Choudhuri et al ⁹	Present study
1.	Absorption of					
	o Terminal phalanges	8.0%	84.0%	59.2%	48.2%	40.0%
	o Middle phalanges	8.0%	72.0%	34.2%	27.2%	32.0%
	o Proximal phalanges	10.0%	60.0%	19.7%	13.6%	18.0%
	o Metacarpals	-	22.0%	10.5%	10.9%	2.0%
	Heads of bones	5.5%				
	Shafts of bones	7.4%				
2.	Soft tissue changes	-	74.0%	39.5%	44.5%	16.0%
3.	Concentric absorption	14.0%	68.0%	39.5%	32.7%	32.0%
4.	Contracted fingers/claw hand/ claw toes	-	38.0%	36.8%	22.7%	64.0%
5.	Tuft erosion of terminal phalanx	27.0%	56.0%	15.8%	13.6%	32.0%
6.	Arthritis					
	o Acute	4.7%				
	o Chronic	10.0%	10.0%	14.5%	26.4%	18.0%
7.	Subluxation and/or dislocation	4.5%	28.0%	10.5%	18.2%	32.0%
8.	Cupping of joints	0.2%	6.0%	7.9%	6.4%	22.0%
9.	Fractures	-	4.0%	6.6%	3.6%	4.0%
10.	Secondary periostitis	9.0%	18.0%	6.6%	3.6%	8.0%
11.	Osteomyelitis	5.6%	14.0%	5.3%	4.5%	6.0%
12.	Disintegration of tarsal bones	2.1%	-	1.3%	1.8%	8.0%
13.	Eccentric absorption	-	2%	-	2.7%	18.0%
14.	Acute osteitis	1.0%	-	-	-	-
15.	Others	-	-	-	22.7%	32.0%

Table 8 : Comparison of the frequency of skull and paranasal sinus changes observed in various studies with present study

S. No.	Skull and paranasal sinus changes	Barnetson J ²	Chhabriya et al ⁸	Hauhmar et al ¹²	Choudhuri et al ⁹	Present study
1.	Maxillary antrum					
	Diffuse opacity		-	21.4%	1.8%	10%
	Local mucosal thickening	87.5%	-	28.6%	-	10%
	Generalised mucosal thickening	100%	-	28.4%	4.5%	18%
2.	Ethmoidal sinus change	44%	-	-	0.9%	2%
3.	Frontal sinus change	31%	-	-	1.8%	-
4.	Atrophy/loss of anterior nasal spine	-	10%	-	-	-
5.	Atrophy/loss of alveolar process of maxilla	-	-	-	-	-

Discussion

Bone lesions occurring in leprosy patients have been recognized as an important feature of the disease for many years (Gass and Rishi 1934, Barnetson 1950 and 1951, Kozuma 1953, Job 1963, Thapa et al 1992, Choudhuri et al 1999). Many of these lesions are secondary and not specifically caused by the leprosy bacillus. Radiological studies undertaken in selected cases, will help the clinician to determine the extent of bone involvement and to suggest the method of treatment likely to be effective in preventing a permanent loss of function.

It has long been evident that direct leprosy involvement of bones is one of the factors in bone absorption. Gass and Rishi (1934) found acid fast bacilli in the bone marrow. Direct leprosy invasion could result in bone atrophy and destruction (Kozuma 1959, Job 1963). However these observations were mostly in the pre MDT era. One of the most important factors in bone absorption is leprosy osteitis and osteomyelitis following ulceration and secondary infection. Even if there is no ulceration of the skin, the metatarso-phalangeal joints and calcaneum are the most affected pressure points in such patients (Skinsnes et al 1972). Specific leprosy changes in the veins lead to disturbance in the normal tonicity and blood flow and may contribute to thrombosis at these sites, resulting in ischemia. These vascular changes may be contributing to mutilation and deformities of hands and feet which occur in leprosy (Bansal et al 1987). There is close relationship between anaesthesia and distal absorption (Lechat 1962). The disturbance of reflex vasomotor response following leprosy neuritis is considered to be one of the important factors in the pathogenesis of neurotrophic atrophy (Barnetson 1950, 1951). Thus various probable factors initiating and sustaining deformities of leprosy and bone absorption are

peripheral nerve damage, specific leprosy inflammation, immunologic reactions and secondary influences (Skinsnes et al 1972).

Bone changes are reported in variable frequencies in different studies. In the present study, 90% patients had bone changes whereas in the study of Chamberlain et al (1931), Paterson (1955), Basu (1962), Thappa et al (1992) and Choudhuri et al (1999), it was 15%, 95%, 91%, 82.9% and 87.3%, respectively. In fact, the frequency of bone changes is more closely related to severity of disabilities. In different studies, specific bone changes in hands and feet were between 3-44.5%, non-specific bone changes in hands, feet were between 45-78.9% and skull & paranasal sinus changes were observed in 9.1% respectively (Paterson 1961, Chhabriya et al 1985, Thappa et al 1992, Choudhuri et al 1999). Frequency of such changes observed in the present study are compared with various reported studies in Tables 6,7 and 8. Variations in the frequencies among various studies may be due to different time periods reflective of diagnostic and therapeutic interventions, geographical factors as well as method of inclusion of cases in different studies. This justified the need to continue to address the issue in different settings as done in the present study.

In the present study, an increase in specific bone changes in hands, feet, skull and paranasal sinus was observed with increasing age. This observation was almost similar to that reported by Choudhuri et al (1999) and at variance to those by Paterson (1961) and Thappa et al (1992). There was no significant difference in specific bone changes in hands feet, skull and paranasal sinus changes ($p > 0.05$) in males in comparison to females while it was significant in case of non-specific bone changes in hands and feet ($p < 0.05$). This difference in gender is similar to that reported by earlier authors. There was some

correlation between farmer occupation and types of bone changes, however, this and the other professions were not sufficiently represented to draw any concrete conclusions.

In the present study, higher percentage of all types of bone changes were seen in LL and BL types of leprosy which reflects the extensive nature of involvement in these types of cases. An increase in duration of disease (> 5 years) resulted in higher incidence of specific and non-specific bone changes in hands and feet. However, skull and paranasal sinus changes were seen in patients with disease duration of ≤ 1 year. Non-specific bone changes in hands, feet, skull and paranasal sinus changes increased with increasing duration of deformities which were similar to those reported by various authors. All types of bone changes increased with increasing disability index.

In the present study, it was observed, that higher percentage of specific bone changes in hands and feet were observed in untreated patients, while non-specific bone changes in hands, feet, skull and paranasal sinus changes were observed in those under treatment for a variable periods of time. These changes were not statistically significant ($p > 0.05$). Similar findings have been reported by earlier quoted workers as well. Paterson (1961) found non-specific bone changes in hands and feet in 56% patients with anaesthesia, in 80% patients with contractures and in 87-94% patients with ulceration and scarring (Table 5). Thappa et al (1992) observed non-specific bone changes in hands and feet in 81.7% of patients with anaesthesia, 83.3% with paralysis, 100% with contractures, 90.5% with infection and ulceration and 100% with absorption of fingers and/or toes. In the present study, 82% patients with anaesthesia, 86.5% patients with contractures and 91.3% patients with trophic ulcers showed non-specific bone

changes in hands and feet. Furthermore, regarding specific bone changes, our observations are also similar to those reported by Paterson (1961) and Thappa et al (1992). Thappa et al (1992) reported that no significant correlation between specific bone changes in hands and feet and various clinical features. However, in the present study specific bone changes were seen in 100% of patients with amputation of fingers/toes, wrist drop/foot drop and type I lepra reaction, 82.6% with trophic ulcer and 80.1% with absorption of fingers and toes (Table 5).

Hauhner et al (1992) observed a correlation between the presence of nasal deformity and antral damage. He observed antral changes in all the patients with nasal deformity while only 40% patients without nasal deformity showed antral changes. Choudhuri et al (1999) found skull and paranasal sinus changes in 9.1% of cases with various types of disabilities and deformities but he did not correlate them with clinical features. In the present study, skull and paranasal sinus changes were seen in 100% cases of Type I lepra reaction (one case only), 20 (40%) cases with amputation of fingers/toes and 19 (38.0%) cases with absorption of fingers/toes. One out of four cases of Type II lepra reaction also showed this type of bone changes (Table 5).

In the present study, 72% of patients showing specific bone changes had duration of deformity of more than 1 year and also maximum percentage of non specific bone changes were seen in patients with duration of deformity of 1-5 years. Further, in our cases these are clearly linked to extent of disease, 86% being MB cases. As bony changes may be result of persisting deformity and also may contribute to its evolution, prevention and early management of disease and its complications including deformities are likely to have impact on reducing bony changes. The highest percentage of specific bone changes as

well as non specific bone changes in hands and feet were seen in patients with disability index (DI) of 1.16-2.0. All skull and paranasal sinus changes were also seen in patients with DI of 1.16-1.5. There was no significant difference in the specific, non-specific bone changes in skull and paranasal sinus in patients receiving treatment (for a variable period) and those who were untreated ($p>0.05$). These changes in the skull and paranasal sinuses may have evolved over a long period thus may take longer period for healing/regeneration if at all this occurs. As nonspecific infection and trauma are considered to be main reasons for bone resorption in most of cases (MacMoran and Brand 1987), it is conceivable that such proper care of limbs in such cases can make a difference.

It is recommended that all patients of leprosy should be subjected to early radiological examination of hands, feet, skull and paranasal sinuses for early detection of various types of bone changes, proper monitoring and early institution of appropriate medical and treatment as well as other preventive measures that will be helpful in preventing deformities/disabilities. As prevention or reduction of deformity is important for the personal, economic and emotional welfare of leprosy patients, usefulness of such monitoring and interventions should be studied in well designed prospective studies.

References

1. Bansal R, Kaur S, Kumar B et al (1987). Venous involvement in leprosy; A venographic and histopathological correlation. *Int J Lepr.* **55**: 499-506.
2. Barnetson J (1950). Skin temperature studies in neural leprosy. *Trans Roy Soc Trop Med Hyg.* **43**: 539-44.
3. Barnetson J (1951). Osseus changes in neural leprosy : radiological findings. *Acta Radiol.* **34**: 47-56.
4. Basu SP (1962). Radiological observation in leprosy. *Indian Practitioner.* **15**: 53-9.
5. Bechelli LM, Martinez-Dominquez V (1971). Disability index for Leprosy patients. *Bull WHO.* **44**: 709-13.
6. Brand PW (1966). Paralysis of nerves in leprosy. *Int J Lepr.* **34**: 184-6.
7. Chamberlain WE, Wayson NE, Garland LH (1931). The bone and joint changes; a roentgenological study. *Radiology.* **17**: 930-9.
8. Chhabriya BD, Sharma NK, Aggarwal GR (1985). Bone changes in leprosy. *Int J Lepr.* **57**: 632-9.
9. Choudhuri H, Thappa DM, Kumar RH et al (1999). Bone changes in leprosy patients with disabilities/ Deformities (A clinico-radiological correlation). *Indian J Lepr.* **7**: 203-15.
10. Dharmendra (1978). *Leprosy.* **1.** Kothari Medical Publishing House, Bombay, pp 197-204.
11. Gass HH and Rishi OP (1934). Examination of bone marrow for *M leprae*. *Lepr India.* **6**: 8.
12. Hauhnaar CZ, Kaur S, Sharma VK et al (1992). A clinical and radiological study of the maxillary antrum in lepromatous leprosy. *Indian J Lepr.* **64**: 487-94.
13. Indian Association of Leprologists (1982). Clinical, histological and immunological features of the five type classification by Indian Association of Leprologists. *Lepr India.* **54**: 22-32.
14. Job CK (1963). Pathology of leprosy osteomyelitis. *Int J Lepr.* **31**: 26-33.
15. Kozuma A (1959). A study of bone marrow in leprosy. *J Kyushu Hemat Soc.* **9**: 32-48.
16. Lechat MF (1962). Bone lesions in leprosy. *Int J Lepr.* **30**: 125-37.
17. MacMoran JW, Brand PW (1987). Bone loss in limbs with decreased or absent sensation: ten year follow-up of the hands in leprosy. *Skeletal Radiol.* **16**: 452-9.
18. Paterson DE (1955). Radiological bone changes and angiographic findings in leprosy with special reference to pathogenesis of atrophic conditions of digits. *J Fac Radiol.* **7**: 35-6.

19. Paterson DE (1961). Bone changes in leprosy, their incidence, progress prevention and arrest. *Indian J Lepr.* **29**: 393-422.
20. Pearson JMH and Ross WF (1975). Nerve involvement in leprosy - pathology, differential diagnosis and principles of management. *Lepr Rev.* **46**: 199-212.
21. Ridley DS and Jopling WH (1966). Classification of leprosy according to immunity - a five group system. *Int J Lepr.* **34**: 255-73.
22. Skinsnes OK, Sakurai I, Aquine TI (1972). Pathogenesis of extremity deformity in leprosy. *Int J Lepr.* **40**: 375-88.
23. Thappa DM, Sharma VK, Kaur S et al (1992). Radiological changes in hands and feet in disabled leprosy patients: A clinico-radiological co-relation. *Indian JLepr.* **64**: 58-66.
24. WHO (1970). WHO *Technical Report Series.* **459**: 206-30.

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