Original Article

Frequency of neurological deficits in Sudanese lepromatic patients

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Abstract: Leprosy has been a major burden on humanity over thousands of years. 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 mycobacteria at a later date. Untreated the disease is progressive and results in permanent damage to the skin, nerves, limbs and eyes.

Objectives: To study the pattern of neurological manifestations among adult Sudanese leprosy patients seen in Khartoum Dermatology Hospital in the period from March 2006 to August 2006.

Methodology: This is a prospective cross-sectional hospital-based study. Seventy adult Sudanese leprosy patients were studied using simple, direct, standardized questionnaire including history and neurological examination, during the period from March to August 2006.

Results: The most common age group affected was 18- 27 years. Male to female ratio was 3:1. Numbness was the most common neurological symptom seen in 77.14%. Each of visual disturbance, headache and bilateral ulnar sensory impairment was detected in 7.14%. Half of the patients had upper limbs sensory nerve dysfunction while 42.86% exhibited sensory nerve dysfunction in the lower limbs. "Gloves and stoking" sensory impairment was the most common finding (30%) while bilateral lateral popliteal sensory impairment was seen with the same percentage. Bilateral median and unilateral posterior tibial sensory impairment were found in 1.43% each. Unilateral radial cutaneous sensory impairment was seen in 2.86%. Approximately half (48.57%) of the patients had upper limbs motor dysfunction. Bilateral ulnar distribution motor affection was seen in 40%. A significant number (41.43%) had upper limbs muscle wasting. Impaired olfaction was the most common cranial nerve sign seen in 12.86%. Leprosy reactions were detected in 21.43%; type 2 reaction in 14.29% while type 1 reaction in 7.14%.

Conclusion: Numbness and limbs weakness were the most common neurological symptoms in leprosy patients. Peripheral nerve sensory impairment was found in half of the patients with "Gloves and stokes" peripheral sensory neuropathy being the most common sensory disturbance. Motor dysfunction was found in 48.57%. Ulnar and median nerves motor affection was the most common motor dysfunctions. Signs related to cranial nerves involvement were less common. Leprosy reactions were present in one-fifth of the patients.

Keywords: *Mycobacterium leprae,* granulomatous, numbness, popliteal.

Leprosy is a chronic granulomatous infectious disease that has been a major burden on human over thousands of years. It was recognized in the ancient civilizations of China, Egypt and India. The earliest report of leprosy dated back to 600 BC[1].

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Perhaps no other disease in the history of mankind has been associated with such a strong social stigma as leprosy. In 1873, Armauer Hansen isolated the bacterium *Mycobacterium leprae* from the lesions of a Norwegian patient, making leprosy the first disease for which an infectious agent was identified. Failure of early detection often leads to severe disability in spite of eradication of mycobacterium at a later date. 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[2-3]. In spite of this the disease accounts for approximately 10 million affected people worldwide. Leprosy remained an incurable disease until 1940, when the first breakthrough occurred with the development of dapsone, a drug capable of arresting the disease[4].Today, it is widely accepted that multi-drug therapy (MDT) renders leprosy curable.

Objective:

To study the pattern of neurological manifestations of leprosy among adult Sudanese patients seen at Khartoum Dermatology Hospital in the period from March 2006 to August 2006.

Methods:

This is a descriptive prospective hospital based cross sectional study. Those below 18 years of age were excluded. All patients gave their consent to participate in the study. A full detailed history and proper systemic and neurological examination was performed by the authors. 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: 1- Hypopigmented or reddish patches with definite loss of sensation.2- Thickened peripheral nerves.3- Acid-fast bacilli on skin smears or biopsy material. Investigations were needed only in cases where the diagnosis was doubtful or where recurrence was suspected. The disease is classified into paucibacillary (PB) and multibacilary (MB) leprosy according to WHO classification. Standard regiments of MDT according to WHO therapeutic guidelines were used for the treatment of the patients included in the study. The following drugs were used: 1- Rifampicin.2- Dapsone.3- Clofazimine. Patients with reactions were treated with prednisolone in addition to MDT. Data were analyzed and discussed.

Results:

Males constituted 74.29% of the patients. 22.86% of the patients were at 18-27 years of age (Table 1).

Table1: Age and sex distribution.

Age	No. (%)	No. (%)	No. (%)
18- 27 yr	16 (22.86)	6 (8.57)	22 (31.43)
28 -37 yr	11(15.71)	5 (7.14)	16 (22.86)
38- 47 yr	9 (12.86)	3 (4.29)	12 (17.14)
48- 57 yr	9 (12.86)	2 (2.86)	11 (15.71)
58 -67yr	3 (4.29)	2 (2.86)	5 (7.14)
≥ 68 yr	4 (5.71)	0 (0.00)	4 (5.71)
Total	52(74.29)	18(25.71)	70 (100)

Geographically 2.86% of the patients were from Eastern region,11.43% from Northern region,8.57% from Khartoum region, 30% from Central region, 18.31% from Kordofan region,8.57% from Darfour region,8.57% were from Upper Nile region,4.29% from Equatorial region and 7.14% were from Bahar Elgazal region. Occupational background showed that farmers constituted 28.57%, house wives 18.57%, students 7.14%, soldiers 4.29% and other different jobs 41.43%. 4.29% of our patients had past history of leprosy while 10% had family history of leprosy. Multibacillary (MB) type of leprosy was found in 82.86% while 17.14% had paucibacillary (PB). Non-neurological manifestations were shown in Fig 1. Nasal discharge was seen in 42.86%.

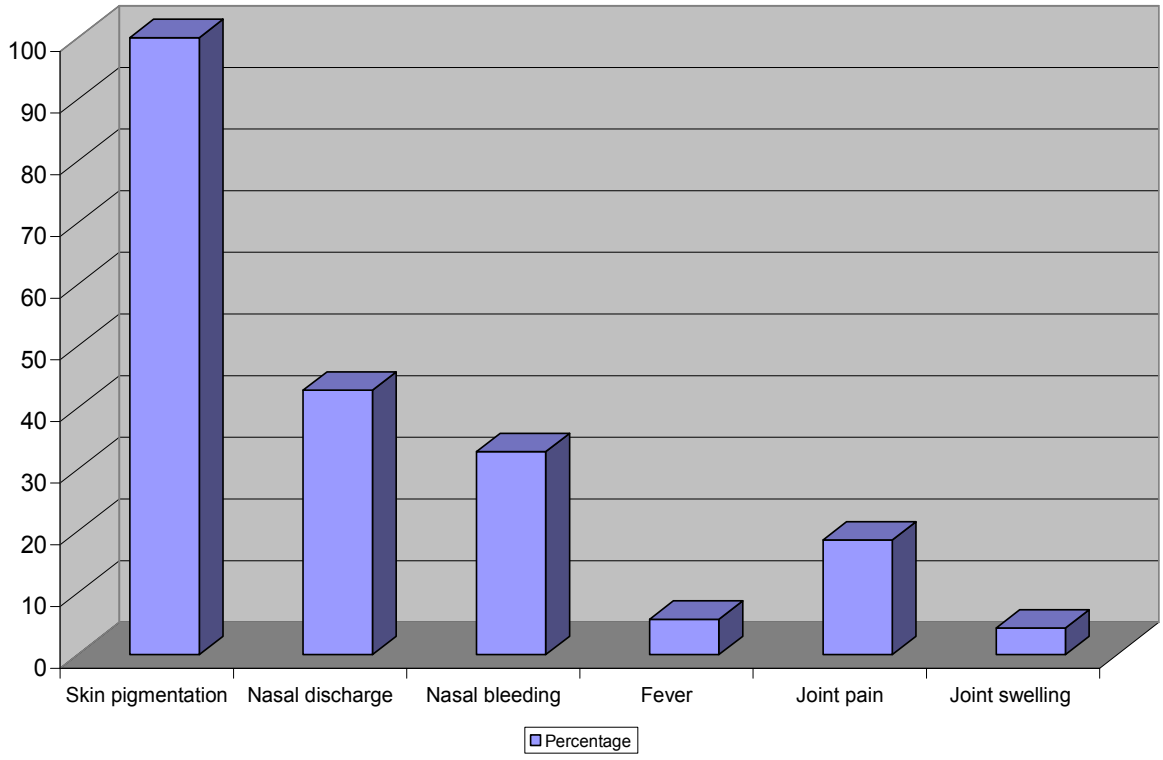

Fig1. The other common presenting non-neurological symptoms.

Skin pigmentation was seen in all (100%) of the patients. Other skin manifestations including macules, plaques, papules, nodules, and ulcers were seen in 78.57%, 44.29%, 14.29%, 12.86% and 5.71% respectively.
General clinical findings included cataract which was detected in 2.86%, perforated nasal septum in 2.86%, enlarged nose in 4.29%, saddle nose in 2.86%, lionine face in 1.86%, testicular atrophy in 2.85%, testicular swelling in 1.43% and lower limbs oedema in 1.43%. Almost 61.43% had no sensory impairment over the skin lesions, 12.86% had sensory impairment confined to some skin lesions and 25.71% had sensory impairment over all skin lesions.

The common presenting neurological symptoms were shown in Table2.

Impaired smelling was detected in 12.86%; all had MB disease. Loss of vision in one eye was seen in 4.29%; more than half of them (2.86%) had MB disease. Impaired vision of one eye in 4.29%; all had MB disease.
Unilateral LMN facial weakness was detected in 5.71%; half of them had MB disease.

Table2: The common presenting neurological symptoms.

Symptoms	NO. (%)
Headache	5 (7.14)
Convulsion	0 (0.00)
Loss of consciousness	0 (0.00)
Smelling disturbance	9 (12.86)
Visual disturbance	5 (7.14)
Inability to close eye	1 (1.43)
UL weakness	22 (31.43)
LL weakness	8 (11.43)
Numbness	54(77.14)
Nerve pain	9 (12.86)
Sphincter disturbance	0 (0.00)

Upper and lower limbs examinations finding were illustrated in table3&5.

Table 3: upper limb findings.

Clinical findings	Total No. (%)	MB No (%)	PB No. (%)
Wasting	29 (41.43)	25 (35.71)	4 (5.71)
Loss of fingers phalanges	8 (11.43)	7 (10)	1 (1.43)
Unilateral true claw	7 (10.00)	6 (8.57)	1 (1.43)
Bilateral true claw	3 (4.29)	1 (1.43)	2 (2.86)
Unilateral ulnar claw	2 (2.86)	2 (2.86)	0 (0.00)
Bilateral ulnar claw	1 (1.43)	1 (1.43)	0 (0.00)
Simian deformity	1 (1.43)	1 (1.43)	0 (0.00)
Ulcers	1 (1.43)	1 (1.43)	0 (0.00)
Normal tone	66 (94.29)	55 (78.57)	11 (15.71)
Hypotonia	4 (5.71)	3 (4.29)	1 (1.43)
Normal power	36 (51.43)	28 (40)	8 (11.43)
Unilateral ulnar weakness	6 (8.57)	6 (8.57)	0 (0.00)
Bilateral ulnar weakness	28 (40)	24 (34.29)	4 (5.71)
Unilateral median weakness	2 (2.86)	2 (2.86)	0 (0.00)
Bilateral median weakness	14 (20)	10 (14.29)	4 (5.71)
Normal reflexes	68 (97.14)	57 (81.43)	11 (15.71)
Hyporeflexia	2 (2.86)	1 (1.43)	1 (1.43)
Normal sensation	35 (50.00)	26 (37.14)	9 (12.86)
"Gloves" pattern sensory impairment	21 (30.00)	19 (27.14)	2 (2.86)
Unilateral ulnar sensory impairment	4 (5.71)	4 (5.71)	0 (0.00)

Table 4: Nerves of upper limbs.

Nerve	Enlarged	Tender
right great auricular	23	6
left great auricular	24	6
right ulnar	66	26
leftt ulnar	69	27
right radial cutaneous	57	13
leftt radial cutaneous	56	14
right lateral popliteal	63	20
leftt lateral popliteal	63	19
right posterior tibial	61	19
leftt posterior tibial	60	17

Leprosy reactions were not detected in 78.57% while 7.14% had type 1 reaction and 14.29% had type 2 reaction. The common symptoms among patients presenting with reactions (15 patients) were fever (26.67%), nerve pain (60%), erythematous rash (86.67%), joint pain (53.33%) and joint swelling (13.33%).

Discussion:

The study showed that males were affected more than females this is similar to what was mentioned worldwide[5-7]. It appeared that the age group 18 - 27 years is the most common group affected, this is similar to what was reported in the literature. This group being the most active sector of the community highlights the need for early detection and treatment of the disease[8-9]. The prevalence seemed to decrease with age being less common (5.71%) in the age group >68 years.

Geographical distribution showed that 30% of our patients were from the central region, although the disease was found in all other regions. This may be due to easy travel to Khartoum rather than giving a real clue to distribution of the disease in Sudan.

Considerable number of patients (28.57%) were farmers raising the possibility of occupational hazards which is not proven yet and needs further scientific verification[5].

The vast majority of our patients (95.71%) had no past history of similar condition; this could be due to the fact that the course of the disease is usually prolonged and silent without remissions and relapses.

Table 5: sensory impairment in upper and lower limbs

Clinical findings	Total No(%)	MB No(%)	PB No(%)
Bilateral ulnar sensory impairment	5(7.14)	4(5.71)	1(1.43)
Unilateral median sensory impairment	4(5.71)	4(5.71)	0(0.00)
Bilateral median sensory impairment	1(1.43)	0(0.00)	1(1.43)
Unilateral radial cutaneous sensory impairment	2(2.86)	2(2.86)	0(0.00)
Bilateral radial cutaneous sensory impairment	0(0.00)	0(0.00)	0(0.00)
Normal coordinaton	69(98.57)	58(82.86)	11(15.71)
Impaired coordination	0(0.00)	0(0.00)	0(0.00)
Difficult to coordination	1(1.43)	0(0.00)	1(1.43)
Wasting	9 (12.86)	9 (12.86)	0 (0.00)
Drop feet	1 (1.43)	1 (1.43)	0 (0.00)
Deep ulcers	3 (4.29)	3 (4.29)	0 (0.00)
Loss of toes phalanges	5 (7.14)	3 (4.29)	2 (2.86)
Normal tone	68 (97.14)	56 (80)	12 (17.14)
Hypotonia	2 (2.86)	2 (2.86)	0 (0.00)
Normal power	67 (95.71)	55 (78.57)	12 (17.14)
Unilateral posterior tibial weakness	0 (0.00)	0 (0.00)	0 (0.00)
Bilateral posterior tibial weakness	1 (1.43)	1 (1.43)	0 (0.00)
Unilateral lateral popliteal weakness	1 (1.43)	1 (1.43)	0 (0.00)
Bilateral lateral popliteal weakness	2 (2.86)	2 (2.86)	0 (0.00)
Normal reflexes	60 (85.71)	48 (68.57)	12 (17.14)
Hyporeflexia	10 (14.29)	10 (14.29)	0 (0.00)
Normal sensation	40 (57.14)	31 (44.29)	9 (12.86)
"stockes" pattern sensory impairment	21 (30.00)	19 (27.14)	2 (2.86)
Unilateral posterior tibial sensory impairment	1 (1.43)	1 (1.43)	0 (0.00)
Bilateral posterior tibial sensory impairment	3 (4.29)	2 (2.86)	1 (1.43)
Unilateral lateral popliteal sensory impairment	4 (5.71)	4 (5.71)	0 (0.00)
Bilateral lateral popliteal sensory impairment	4 (5.71)	3 (4.29)	1 (1.43)
Normal coordination	70 (100.00)	58 (82.86)	12 (17.14)
Impaired coordination	0 (0.00)	0 (0.00)	0 (0.00)

Almost 90% of our patients had no family history of leprosy, this is similar to a study done in Canada and it differs from what was mentioned in the literature where the presence of family history is increased up to 50% in the endemic countries[7- 11]. We think that family history is very important because proximity to leprosy patients is an important determinant of transmission.

Up to 82.86% of our patients had MB form of the disease similar to distribution in some countries (eg. Mexico) but it differs from what has been reported in Africa[12- 14]. The common presenting non-neurological symptoms were found to be skin pigmentation (100%) and nasal discharge (42.86%) similar to what was mentioned in the literature and this is the classical presentation of leprosy particularly MB form[15,16].

The pattern of skin manifestations among our patients showed that macules (78.57%) and plaques (44.29%) were the most common skin lesions, this is similar to other reports[17, 18]. Considerable number of our patients had no sensory impairment over skin lesions (61.43%), 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 which dominates our patients[19,20].

General examination showed variable signs eg. cataract, perforated nasal septum, saddle or enlarged nose, testicular atrophy and lower limbs swelling; this goes with the fact that leprosy is a generalized disease with multisystem involvement[21-23].

It appeared that numbness (77.14%) and weakness of the limbs (31.43%) were the most common neurological symptoms similar to what was mentioned elsewhere[24,26]. This is because leprosy affects peripheral nerves leading to sensory disturbance and weakness in addition to destruction of bones[27, 28]. The study showed that impaired smelling was detected in 12.86%, this may be attributed to involvement of nasal mucus membranes by the disease[29, 30]. Lower motor neuron facial weakness was detected in 5.71% but no patient was found to have trigeminal nerve involvement which is similar to what was reported earlier[2, 25, 31]. Impairment or loss of vision was found in smaller numbers, similar to what was mentioned in the literature[32, 33]. Blindness in our study was found to be less than what was mentioned in a study done in Nepal[34].

Examination of upper and lower limbs revealed that wasting, upper limbs weakness and sensory disturbance were found to be the commonest signs. In upper limbs, half of our patients had sensory nerve dysfunction, and approximately half of the patients had motor dysfunction." Gloves" pattern of sensory impairment (30%) was the most common sensory dysfunction, whereas bilateral ulnar distribution weakness (40%) followed by bilateral median distribution weakness (20%) were the most common motor dysfunction. In the lower limbs, significant number of patients (42.86%) exhibited sensory nerve dysfunction, while a minority (4.29%) had motor dysfunction.

" Stokes" pattern of sensory impairment (30%) was the most common sensory dysfunction detected in the lower limbs, whereas lateral popliteal weakness (4.29%) was the most common motor dysfunction, this distribution of sensory and motor involvement is more or less similar to what was mentioned by Bogglid et al[7]. However, it seems that our patients were more affected; this can be explained by delayed presentation of our patients and by the fact that most of our patients had MB form of leprosy.

The common nerves found to be enlarged was the ulnar nerve, followed by the lateral popliteal and posterior tibial nerves this is slightly different from what was mentioned in the literature[35,36]. This finding represents the most common presenting sign in leprosy.

Almost 21.43% of our patients were found to have reactions at the time of study which is generally in agreement with Andrea K. Bogglid et al findings but differed in that type 2 reaction was found to be more common (14.29%) than type 1 reaction (only 7.14%).[34]This can be explained by the fact that most of our patients had MB form. It appeared that reactions commonly presented with erythematous rashes, nerve pain, arthralgia and fever which is similar to what was mentioned in the literature[37, 38].

Conclusion: Numbness and limbs weakness were the most common neurological symptoms in leprosy patients. Peripheral nerve sensory impairment was found in half of the patients with "Gloves and stokes", peripheral sensory neuropathy being the most common sensory disturbance. Motor dysfunction was found in 48.57%. Ulnar and median nerves distribution motor affection was the most common motor dysfunctions. Signs related to cranial nerves involvement were less common. Leprosy reactions were present in one-fifth of the patients.

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