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## Original Article

# Clinical Manifestations of Mesoendemic Onchocerciasis in an Area with Multiple Filarial Species

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## Abstract

**Background:** The Imo River Basin, Nigeria is endemic for onchocerciasis, bancroftian filariasis, loaiasis and mansonellosis. This study was aimed at determining the clinical manifestations of onchocerciasis in this region.

**Methods:** A cross-sectional study was carried out in 2006 in Umuowaibu I and Ndiorji communities in Okigwe Local Government Area of Imo State, Nigeria. Consenting individuals were examined for various gradations of skin manifestations, subcutaneous nodules, and visual impairments by qualified medical doctors. Five categories of skin manifestations were observed, namely permanent itching, onchodermatitis, atrophy of skin, leopard skin, and sowda. A total of 1024 individuals were examined.

**Results:** The prevalence of the skin manifestations were permanent itching (2.5%), onchodermatitis (3.9%), atrophy of the skin (5.8%), leopard skin (22.1%), and sowda (0.1%). The prevalence of subcutaneous nodules was 25.3%, but 88.9% among the oldest age group, and mostly found in lower half of body. The majority of cases of visual acuity problems (6.8% overall prevalence) were in the oldest age groups. Among those who were  $\geq 20$  years old, the prevalence of visual acuity problems was significantly higher in females than in males ( $\chi^2$ -test;  $P < 0.05$ ). Only two of the examined persons were observed to be blind.

**Conclusion:** Clinical manifestations of onchocerciasis are perhaps more intense in the area probably because of presence of endemic infections of other filarial species.

**Keywords:** *Onchocerciasis, Clinical manifestations, Subcutaneous nodules, Itching, Nigeria*

## Introduction

Human infection with *Onchocerca volvulus* is an important public health problem of global concern despite resounding control achievements in some areas of West Africa and the Americas. The disease is endemic in Africa, Latin America, and Yemen (1). Recent estimate indicating that at least 37 million people remain infected, mostly in Africa (2), while new endemic foci are still being discovered indicating therefore that its distribution could be far more extensive than has been earlier assumed (3). It has a high damaging potential to the social life of patients especially the stigmatizing premature ageing and lizard skin presentation (4). Onchocerciasis may not directly cause death but it carries great social and economic consequences.

The symptomatology of onchocerciasis has revealed the clinical manifestations to include onchocercal inflammatory skin damage, visual impairments, onchocercomata, lymphadenopathy and ocular lesions, as well as the irreversible terminal effect of blindness in some areas. Onchocercal skin disease is a leading cause of morbidity in endemic areas, resulting in psychosocial consequences and isolation (5, 6). The World Health Organization has estimated the disease burden due to onchocerciasis at 884 000 Disability Adjusted Life Years (DALYs), 60% of which is accounted for by onchocercal skin diseases (7).

In southeastern Nigeria, the main onchocerciasis-endemic focus is situated in the Imo River Basin, which traverses three states of Imo, Abia and River States and represents the area with the highest population density in Nigeria outside Lagos. Here, eleven species of *Simulium damnosum s.l.* the vectors of *O. volvulus* have been identified (8). More importantly, the area is endemic for

bancroftian filariasis, loaiasis, and mansonnellois (9-11).

This work represents the first comprehensive study on the clinical manifestations of meso-endemic onchocerciasis in an area endemic for multiple species of human filarial worms.

## Materials and Methods

### *Study area and study population*

The study was conducted in two neighbouring communities of Umuowaibu 1 and Ndi-orji, in Okigwe Local Government area of Imo State, Nigeria. The two communities with a combined population of 1,116 are socio-culturally similar. A familial settlement pattern was evident in the area with houses arranged in family clusters. A total of 381 houses were recorded.

### *Informed consent and Ethical review of protocol*

Informed consent was obtained from all individuals or guardians (for children  $\leq$  15 years). The Ethics Committee of the Local Government Area (LGA) health authorities approved the protocol.

### *Clinical surveys*

All consenting individuals in the selected communities who were more than one year of age were included in the study population, which comprised natives as well as non-natives who had resided there for at least one year. Those who were sick with minor ailments were given medicine. Individuals were examined for various gradations of skin manifestations and visual impairments by qualified medical doctors. The grading was carried using skin manifestations as presented in Table 1.

### **Data analysis**

The Epi-Info version 6 .0 was used in entering data from parasitological survey, and SPSS for windows (1995 version) was used for data analysis. The geometric mean intensity (GMI) of microfilaraemia was calculated as  $\text{antilog}(\sum \log(x+1)/n)$ , with x being the number of mf per ml of blood in microfilaraemic individuals and n the number of microfilaraemic individuals examined.

### **Results**

Clinical manifestations in relation to onchocerciasis focused on skin manifestations, subcutaneous nodules, and visual impairment. Five categories of skin manifestations were recorded, namely permanent itching (PI), onchodermatitis, atrophy of skin (AS), leopard skin (LS), and sowda. The occurrence of the first three, considered as progressive stages of chronic inflammatory damage, is presented in Table 2, while the occurrence of LS in relation to age and sex is presented in Table 3.

The overall prevalence of itching was 2.5% (2.0% for males and 3.1% for females), it appeared quite early in life (youngest victim was 3 years old), and was more predominant on the limbs than on the rest of the body. No individual above an age of 39 years was observed with permanent itching.

The overall prevalence of onchodermatitis was 3.9% (1.8% for males and 6.0% for females). The youngest victim was 8 years old. The majority of cases were among individuals  $\leq 39$  years old. Among this group, it was significantly higher ( $\chi^2$ -test;  $P < 0.01$ ) among females (6.7%) than among males (2.4%), and was predominant on the limbs. AS was observed in 5.8% (2.2% for males and 9.2% for females) of the individuals examined. The youngest individual presenting

AS was 13 years old. Prevalence was significantly higher in females than in males ( $\chi^2$ -test;  $P < 0.001$ ). LS was common with an overall prevalence of 22.1% (26.5% for males and 17.7% for females). The youngest victim was 9 years old.

Among those  $\geq 20$  years, who presented most cases, the prevalence rose steadily with age to reach 81.5% in the oldest age group. All the men of the 60+ years age group had LS, which was also the only skin manifestation observed in men in this particular age group. Among those who were  $\geq 20$  years old also, the prevalence was significantly higher in males than in females (50.0% and 31.3%, respectively;  $\chi^2$ -test;  $P < 0.001$ ). LS was observed mostly in the lower parts of the arms and legs.

Sowda was observed in only one woman who was 50 years old (0.1% prevalence). The characteristic black pigmentation with thickening and roughness of skin was localized on one leg. No cases were found in males. No case of hanging groin was observed.

A comparison of the prevalence of LS and the pooled prevalence of chronic inflammatory skin damage (CISD) in relation to age and sex is presented in Fig. 1. CISD was mainly found among younger individuals (mostly those  $\leq 40$  years old) while the LS was a clinical sign seen mainly in older people (mostly those  $\geq 40$  years old). The prevalence of CISD tends to fall with the passing of years, and this fall coincides with the rise in the prevalence of leopard skin.

Occurrence of subcutaneous nodules in relation to age and sex (Fig. 2) showed overall prevalence of 25.3% (27.3% for males and 23.3% for females). The youngest sufferer was 11 years old. Generally, the prevalence of subcutaneous nodules rose with age to reach 88.9% in the oldest age group. The prevalence of subcutaneous nodules among

adults ( $\geq 20$  years old) was 44.4% (49.3% for males and 39.9% for females). This was significantly higher than prevalence among those who were below 20 year old, which was 2.6% (2.5% for males and 2.6% for females) ( $\chi^2$ -test;  $P < 0.001$ ). The nodules were mostly observed in the lower half of the body, especially in the hip region.

The prevalence of the three stages of visual acuity problems (VAP) in relation to age and sex is presented in Fig. 3. The overall prevalence of VAP was 6.8% (4.8% for males and 8.9% for females). Of all who had visual acuity problems, related to filariasis, only one individual was below 20 years of age (a girl of 5 years). The prevalence of

VAP rose from 3.6% in the 20-39 yr age group to 18.5% in the 40-59 yr age group, and to 44.4% in the oldest age group. The majority of cases of VAP were observed in the oldest age groups. Among those who were  $\geq 20$  years old, the prevalence of VAP was significantly higher in females than in males ( $\chi^2$ -test;  $P < 0.05$ ).

The commonest VAP was visual impairment (5.2% overall, 3.2% for males; 7.1% for females), followed by severe visual impairment (1.4% overall, 1.4% for males; 1.3% for females). Blindness was not common (0.2% overall, 0.2% for either sex). The blind female was 27 years old, while the blind male was 86 years old.

**Table 1:** Legends to the stages of clinical manifestations of onchocerciasis in the UIRB

Clinical sign/symptom	Grading	Description
Skin manifestation	0	Normal
	1	Permanent itching without onchodermatitis
	2	Onchodermatitis (with papules/thickening of skin/secondary infections)
	3	Atrophy of skin, loss of elasticity, paper thin skin (prematurely aged)
	4	Mottled depigmentation (leopard skin)
	5	Sowda (hyperpigmented thickened skin, unilateral)
Visual manifestation	6	Hanging groin
	0	No visual impairment (6/18 or more in Snellen Chart)
	1	Visual impairment (3/60 < reads < 6/18 in Snellen Chart)
	2	Severe visual impairment (3/60 < reads < 6/60 in Snellen Chart)
	3	Blind (inability to read (3/60 in Snellen Chart)

**Table 2:** Onchocerciasis-related chronic inflammatory skin damage (CISD) in relation to age and sex in the Upper Imo River Basin

Age group (yr)	No. examined			No. with PI (% prevalence)			No. with OD (% prevalence)			No. with AS (% prevalence)			Total (% prevalence)	
	M	F	M+F	M	F	M+F	M	F	M+F	M	F	M+F	M	F
1-9	102	107	209	1 (1.0)	2 (1.9)	3 (1.4)	0 (0.0)	1 (0.9)	1 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)	3 (2.8)
10-19	135	124	259	7 (5.2)	9 (7.3)	16 (6.2)	8 (5.9)	8 (6.5)	16 (6.2)	1 (0.7)	7 (5.6)	8 (3.1)	16 (11.9)	24 (19.4)
20-39	132	143	275	2 (1.5)	5 (3.5)	7 (2.5)	1 (0.8)	16 (11.2)	17 (6.2)	6 (4.5)	31 (21.7)	37 (13.5)	9 (6.8)	52 (36.4)
40-59	123	131	254	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (4.6)	6 (2.4)	4 (3.3)	7 (5.3)	11 (4.3)	4 (3.3)	13 (9.9)
60+	13	14	27	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (21.4)	3 (11.1)	0 (0.0)	3 (21.4)
Total	505	519	1024	10 (2.0)	16 (3.1)	26 (2.5)	9 (1.8)	31 (6.0)	40 (3.9)	11 (2.2)	48 (9.2)	59 (5.8)	30 (5.9)	95 (18.3)

**Table 3:** Leopard skin in relation to age and sex (M = Males; F = Females)

Age group (yr)	No. examined			No. with leopard skin (% prevalence)		
	M	F	M+F	M	F	M+F
1-9	102	107	109	0 (0.0)	2 (1.9)	2 (1.0)
10-19	135	124	159	0 (0.0)	0 (0.0)	0 (0.0)
20-39	132	143	175	26 (19.7)	11 (7.7)	37 (13.5)
40-59	123	131	154	95 (77.2)	70 (53.4)	165 (65.0)
60+	13	14	27	13 (100.0)	9 (64.3)	22 (81.5)
Total	505	519	1024	134 (26.5)	92 (17.7)	226 (22.1)

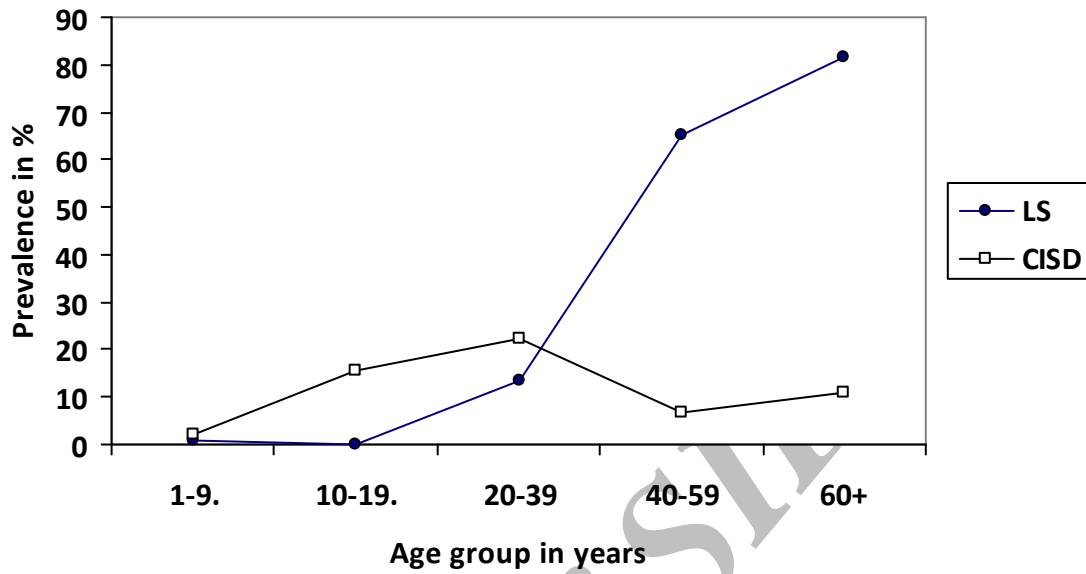


Fig. 1: Overall prevalence of chronic inflammatory skin damage (CISD) and prevalence of leopard skin (LS) in different age groups

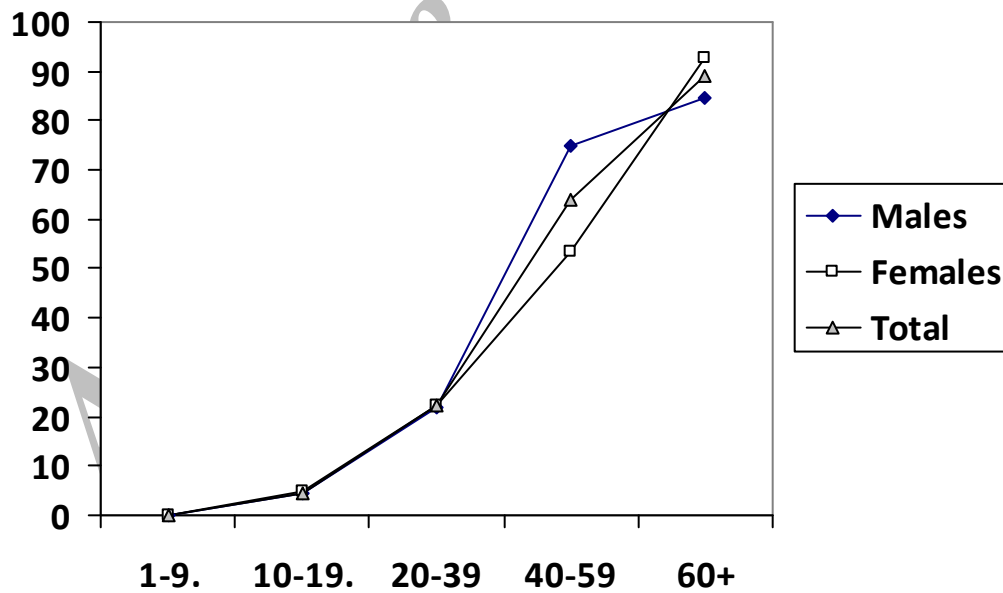
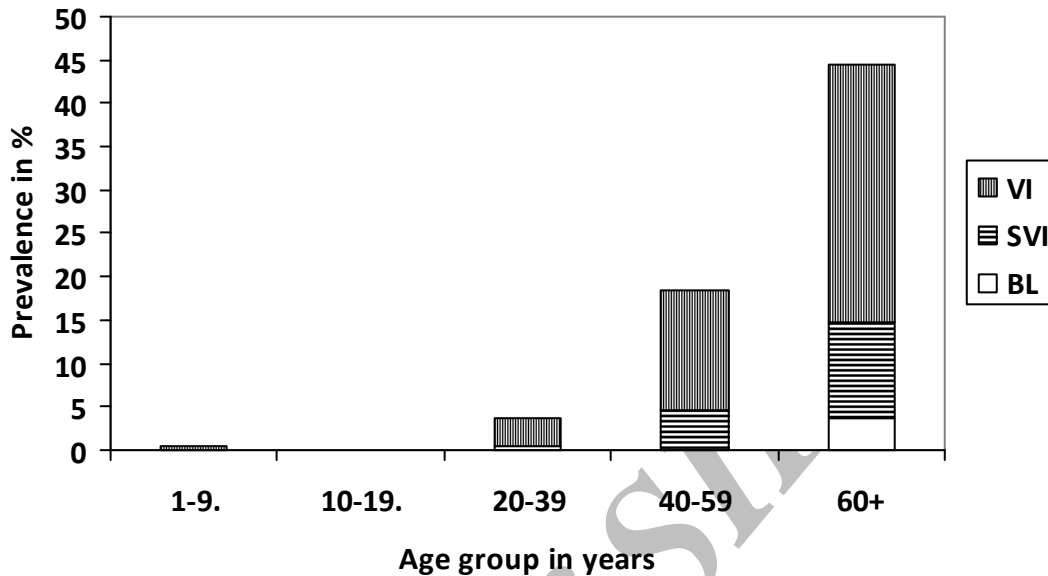


Fig. 2: Prevalence of subcutaneous nodules in relation to age and sex



**Fig. 3:** Prevalence of the three stages of visual acuity problems in different age groups (VI = visual impairment; SVI = severe visual impairment; BL = blindness)

## Discussions

The commonest clinical manifestation related to onchocerciasis observed in the upper Imo River Basin (UIRB) was leopard skin. This was more common in our study than reported from the savannah area (12). The prevalence was higher among males than females. It was most common among older individuals and all individuals  $\geq 60$  years old had it. This supports the view that clinical manifestation occurs in long standing onchocerciasis infection (13). Infection in the area is contracted mostly in the early years of life, but the absence of clinical manifestations of chronic pathology in children could be because they occur mostly in the post-puberty years (14). Several factors have been put forward as possibly the cause of leopard

skin. These include a dermatotoxic component of the blackfly saliva (15), toxin from microfilaria and/ or adult of *O. volvulus* and anaphylactic causes (16). It has been observed that leopard skin develops in shins of lower limbs, which are repeatedly exposed, to the bites of blackflies (17). However, it has been observed that patients with onchocerciasis develop leopard skin at sites not readily exposed to biting blackflies (such as penis, scrotum, inguinal folds, and axillae) and that the pruritic scratching may promote leopard skin (18). Other studies on etiology of leopard skin have revealed that microfilariae degenerating in the upper dermis provoke inflammation, which is acute at first but later becomes chronic (13). However, the patho-

genesis of LS is associated with long standing onchocerciasis (12).

CISD, including PI, onchodermatitis and AS were common. Sowda was rare in the area and is not a common clinical manifestation of *O. volvulus* infection (19). There was higher prevalence of PI than other stages of CISD and of LS among young children. This indicates that PI is perhaps, the commonest symptom of onchocerciasis in the early infection. This is supported by the finding in the Lower Imo River Basin where PI was the commonest clinical manifestation of sporadic onchocerciasis (9). In this study, the prevalence of PI seems to correlate with that of microfilaraemia, and is corroborated (20). From our observations, the prevalence of CISD tends to fall with the passing of years, and this coincides with the rise in the prevalence of LS. It remains to be discovered whether inflammatory skin damage is a precursor of leopard skin. CISD was a disease commonly found among the younger individuals. The frequency of permanent itching among young people exceeded that of onchodermatitis, atrophy of skin and leopard skin in that order. It may indicate that probably these clinical manifestations may be successive pathological stages in the disease process.

Subcutaneous nodules were observed in over a quarter of the study population in the UIRB, mostly in the older age groups. The commonness of subcutaneous nodules in an area is an indication of the severity of onchocerciasis disease in the area (21). It was comparable between males and females. Sex-related pattern of prevalence of microfilaraemia and of subcutaneous nodules were similar. This agrees with report (22) that in hyper endemic areas of West Africa, there is a high degree of correlation between the rates of nodule carriers and the rate of microfilarial carriers. This informed the rec-

ommendation of that the presence of palpable nodules be used as quick means for disease assessment (23). We recommend that the combined prevalence of palpable subcutaneous nodules and of inflammatory skin damage be used in combination as rapid assessment tool, as observation in this study indicated. Most of the nodules were observed in the lower half of the body as expected in both rainforest and savannah areas of Africa (24).

Visual acuity problems were observed in 6.8% of the people, while only two individuals were blind. Onchocerciasis in the UIRB is of the forest type, which is associated with little or no blindness (23). Our findings are consistent with findings in the sub-region (23, 25). Significantly, higher blindness rates are reported from savannah zone of Nigeria (26), and the reason for this disparity is common knowledge. Not all visual acuity problems in UIRB may be onchocerciasis-related. Majority of those who had visual acuity problems were those who were engaged in or associated with the traditional fish smoking practice. The accumulated effects of prolonged exposure to smoke may be contributory (9). The preponderance of visual impairment among the older age group agrees with findings elsewhere (26). From the foregoing, the overall cumulative picture clinical manifestations of onchocerciasis is perhaps more intense in the Upper Imo River Basin than in other rainforest onchocerciasis endemic areas probably because of the presence of endemic infections of other filarial species earlier reported (9-11).

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