MODULE

Onchocerciasis

For the Ethiopian Health Center Team

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This material is intended for educational use only by practicing health care workers or students and faculty in a health care field.

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Preface

Onchocerciasis, also called “river blindness” is a tissue parasite transmitted by the vector black fly similum. The microfilriae is responsible for the lesion in the skin and eye. It is not only the disease that causes personal suffering but also of very high socio economic significance in most endemic areas of Ethiopia. It is one of the diseases comprised in prevention & control program.

The health team who are working at lower health care delivery system, lack references and the surveillance of onchocerciasis is still weak in most health services. Considering the responsibility and involvement of the Health Centre Team in onchocerciasis control program the Carter Centre initiated & assisted the preparation of this module.

The module is designed for the Ethiopian Health Centre Teams who are expected to work at district level. The information contained in this module will benefit the health professionals working at middle health care level. By studying this module, the Health Center Team will have current knowledge and reliable information on morbidity, mortality and trends of the disease in order to guide onchocerciasis control program.

The purpose of this self-learning module is to provide the mid level health professionals with the necessary knowledge and skills to competently care for the patient & community at large.

This module is intended to cover the main aspects of onchocerciasis. It is hoped that this module has been prepared in a suitable form for use more selectively by the Health Centre Team. It is of course not intended to provide complete instruction, but intended for use as a guide. It needs to be supplemented by standard books and periodicals. The authors therefore encourage further reading to enrich your knowledge and maintain skills.

UNIT ONE
INTRODUCTION

1.1. Purposes and uses of the module

This module is prepared for Health Officers, Professional Nurses, Environmental Health officers and Laboratory technologists who need to work as cooperative team members. Other categories of staff such as clinical nurses and health centre team in the service areas could use the module too.

The module will serve as a practical guide to the management of Onchoserciasis. It enhances the theoretical knowledge acquired in the different disciplines with practical approach. However, it is not meant to substitute for other reference materials and text books.

The module will also help individuals to work together as a team. The core module emphasizes the areas that need to be known by all categories of health centre team members. The satellite modules however concentrate on specific tasks and skills that need to be acquired by each category of the health centre team. The contents of the satellite modules include portions that are not addressed by the core module, but are essential for each professional category.

After going through the module, the reader will be able to appreciate the contributions that could be made by each health centre team member and caregiver/self-care taker. Above all, it enables them to identify the tasks and activities required in preventing and controlling onchocerciasis.

1.2. Directions for using the module

To be well equipped with the necessary knowledge and provide competent care for a patient with onchocerciasis by using this module, follow these directions:

- Study and answer all the questions in the pre-test that correspond to all categories in the Core Module, and to the specific questions that correspond to your category in the respective Satellite Modules.
- After the pre-test go through the core module

- Each category of the health centre team should read their respective satellite module
- Answer all the questions in the pre-tests and compare your results using the keys after finishing the core and satellite modules
- Study and discuss the specific learning objectives, activities and roles of each category of the health centre team.

UNIT TWO

CORE MODULE

2.1 Pre-test for all Categories of the Health Centre Team

Attempt all of the following questions.

1. What is the etiologic agent of onchocerciasis?
2. _____ is the important vector in the transmission of onchocerciasis
3. How much of the Ethiopian population do you think is at risk of getting onchocerciasis?
4. How is onchocerciasis transmitted?
5. List the complications of onchocerciasis.
6. Discuss the differential diagnoses of onchocerciasis.
7. Which of the following is (are) not clinical manifestations of onchocerciasis?
   - A. Subcutaneous nodules
   - B. Lichenification
   - C. blindness
   - D. Itching
   - E. Splenomegally
8. What diagnostic method can be used to diagnose onchocerciasis?
   - A. Skin snip
   - B. DEC Patch test
   - C. Blood film
   - D. Stool exam
   - E. A and B
9. Which one of the following is the drug of choice for the treatment of onchocerciasis?
   - A. Diethyl carbamazine
   - B. Ivermectin
   - C. Suramin
   - D. Doxycyclin
   - E. Albendazole
10. Which one of the following is the most feasible onchocerciasis control method?
    - A. Attacking the agent
    - B. Attacking the vector
    - C. Control measures directed at the human host
    - D. Clearing swampy areas
    - E. none

2.2. Significance and brief description of onchocerciasis

Onchoserciasis is commonly called River blindness after its geographic locus and most visible symptom. Overall, it causes blindness, disfigurement, and unbearable itching in victims, while rendering large tracts of farmland uninhabitable. It is the second leading cause of preventable blindness worldwide and poses serious public health problem creating an obstacle to socio-economic development in Africa, where it is endemic in 30 countries. In the last fifty years onchocerciasis has been spreading to previously non-endemic regions of Ethiopia. Although comprehensive epidemiological surveys are lacking, it is estimated that 7.3 million people or 17.4% of the population of Ethiopia is at risk from this disease. In view of agricultural development projects and resettlement of millions of people from the highlands into endemic areas in southern and north-western parts of Ethiopia, further spread of onchocerciasis is expected.

Experience gained in the control of the disease in West Africa by WHO and the introduction of effective mass chemotherapeutic agents as well as primary health care programme and activities currently underway in Ethiopia indicate the feasibility of starting control programme. A plan is therefore made to consider controlling the devastating health impacts of onchocerciasis in Ethiopia urgently. Preparation of this module will have a great contribution to this end.

2.3. Learning objectives

Upon completion of the activities in this module, the learner will be able to:

1. Describe the cause and mode of transmission of onchocerciasis.
2. Describe the clinical manifestations of onchocerciasis.
3. List the appropriate diagnostic methods for onchocerciasis at the health centre level.
4. Be able to administer the recommended treatment for onchocerciasis at the health centre level.
5. Mention the different preventive and control methods for onchocerciasis.

2.4 Definition

Onchocerciasis (river blindness) is a chronic parasitic disease affecting skin and eyes. The adult worms live inside fibrous nodules in subcutaneous tissues. The fertilized female worms release thousands of microfilariae that migrate through the lymphatic vessels and cause inflammatory reactions responsible for the skin and eye lesions while they die and degenerate.

2.5 Aetiology

The causative agent for onchocerciasis is a parasitic filarial worm *Onchocerca volvulu*s, of the family filaridae, which lives in the human body for up to 14 years. Each adult female worm is capable of producing millions of microscopic prelarvae (microfilariae) throughout its life span.

2.6 Epidemiology of onchocerciasis

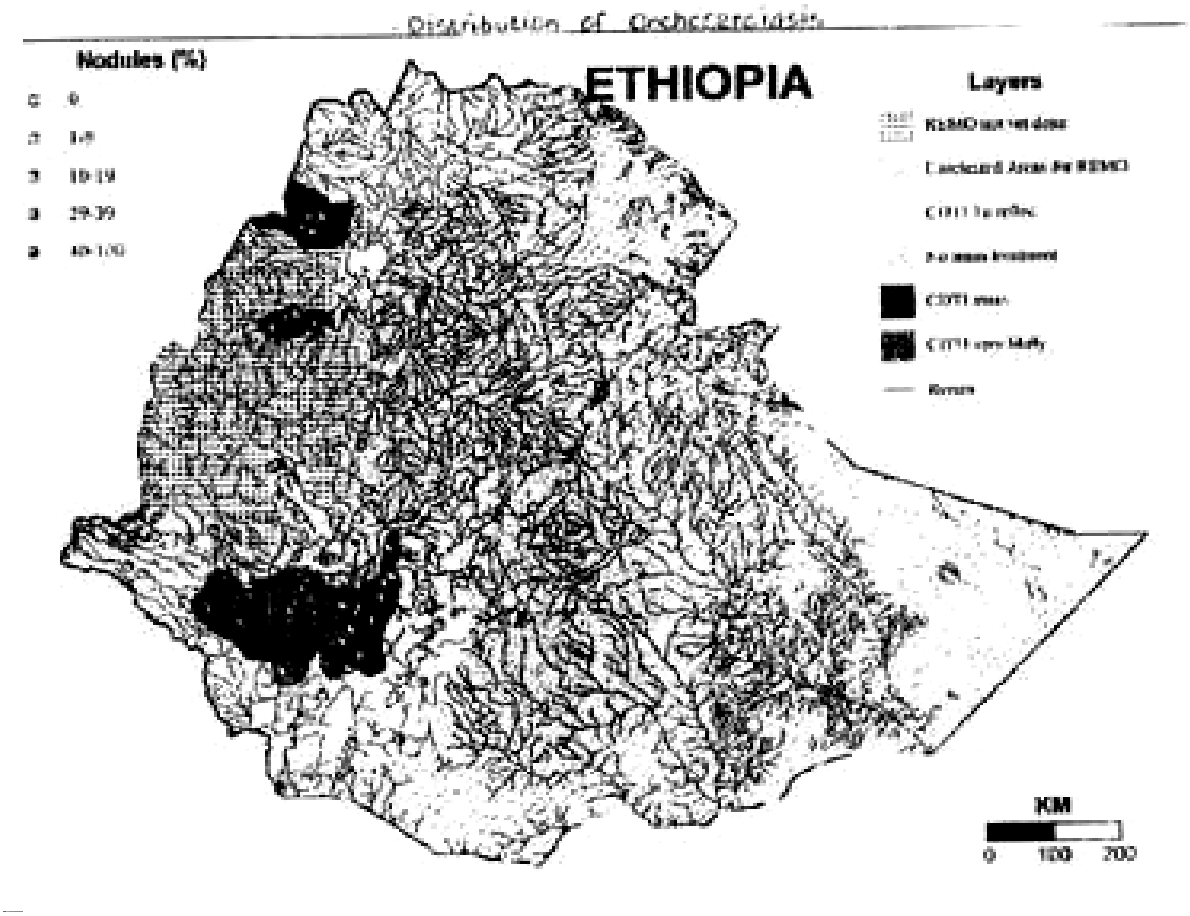
2.6.1. Magnitude

Global:

- Onchocerciasis occurs in 35 countries worldwide, predominantly in West and sub-Saharan Africa. Foci of infection occur in Mexico, Central and, South America, and the Arabian Pennisula.
- More than 123 million people live in endemic areas, and an estimated 18 million people are currently infected.
- Of those infected, about 270,000 are blind and an additional 500,000 have severe visual impairment
- Out of the estimated 18 million infected people worldwide more than 80% live in Africa.
- The incidence of onchocerciasis has been significantly reduced worldwide after the launching of OCP.

Ethiopia:

In Ethiopia 7.3 million people are at risk of infection and 1.38 million people are estimated to be affected by the disease. The endemic areas extend from the northwest part to southwest part of the country that borders the Sudan. The main endemic focal areas in Ethiopea are Kefa-Sheka and Bench Maji zone in south west and Pawi –Metema in North West.



2.6.2. Susceptibility

- Race

All persons in endemic areas, regardless of race, are at risk of infection. Socioeconomic differences (occupation as related to exposure to black fly bites, i.e., farmers, fishermen) have been clearly identified as a contributing factors.

- Sex

Although no reported differences of exposure exist between men and women, men may be afflicted more often because of farm and field occupation.

- Age

Increased age results in cumulative exposure in endemic areas

2.6.3. Transmission/Life cycle

Onchocerciasis is transmitted by the bite of infected black flies of the genus *Simulium*. Black flies breed in fast flowing streams and rivers because of the demand for highly oxygenated water during the maturation of the larvae. Females require a blood meal for ovulation, and they transmit infective-stage (3^{rd} stage) larvae as well as ingest microfilariae during the blood meal. The black fly tends to stay within 2 km of its breeding site.

Humans are the only definitive host of O. volvulus within the human host, harboring adult filarial worms. The gravid adult female worm releases microfilariae which then migrate out of the nodule and throughout the tissues of the host, concentrating in the dermis. Microfilariae are ingested from the host skin by the bite of a female black fly (Simulium species) during its blood meal. The microfilariae migrate from the gut into thoracic muscles of the black fly; then develop into infective larvae within 6-10 days. The infective larvae migrate to the mouthparts of black fly, and will infect a second human host in the process of taking a blood meal. Infective larvae develop into adult worms in humans over a period of 1 to 2 years.

The adult worms pair and mate in the human host, and, unlike most nematodes that produce eggs, the female *Onchocerca* gives birth daily to thousands of microscopic larvae known as microfilariae. Those microfilariae migrate to tissues and induce inflammatory reaction when they die. The life span of microfilariae is 6-30 months. The adult worms may survive from 5 to 13 years during which time they release millions of microfilariae. The adult female worm reaches 40 to 45 cm in length while the microfilaria reach 0.3 mm in length.

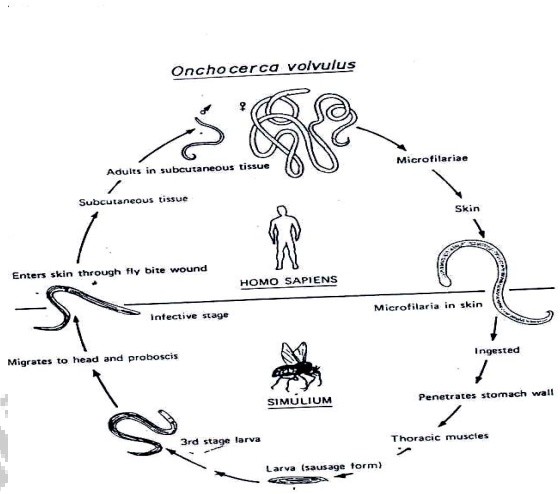


Fig 2.2. Life cycle of Onchocerca volvulus

2.7. Clinical features

HISTORY

- People are living or coming from onchocerciasis endemic areas
- The earliest and most troublesome symptom of onchocerciasis is itching which may be severe.
- Itching is most severe over the sites of highest microfilarial concentration, generally over the lower trunk, pelvis, buttocks, and thighs.
- Other symptoms are subcutaneous nodules, lymphadenopathy, visual changes (can range from reduced vision to frank blindness) and weight loss

Physical findings include skin, soft tissue, and eye abnormalities.

♦ **Skin and soft tissue involvement**

Early signs

- Erythema and edema of the skin with scratch marks
- Papular, pastular, nodular or urticarial lesions on the back, thighs, buttocks, extensor surfaces of upper and lower limbs

- Subcutaneous nodules on the face, back, shoulder, hip, or trunk onchocercomata (containing adult worms).

Late signs

- Lichenification (hyperpigmentation, thickening of the skin with increased skin markings)
- Lizard skin (dryness, roughness and scaling of the skin)
- Leopard skin (atrophy with depigmented and hyperpigmented lesions usually pretibial area)
- Lymphedema (persistent swelling of legs)
- Hanging groin (atrophy of the skin and redundant folds with enlarged inguinal lymphnodes)
- Atrophy of the skin (thinning of the skin with loss of skin markings hanging skin folds seen around the buttocks)
- Redness and swelling of the skin resembling erysipelas rarely occur as Erysipelas de la Costa.

➢ **Eye involvement**

Early sign

- Reduced vision
- Keratitis (redness and dryness of eyes)
- Iridocyclitis (redness around the cornea, photophobia and pain)
- Sclerosing Keratitis (pain and haziness of cornea)

Late sign

- -Sight impairment and blindness

2.8. Differential diagnoses

Onchocerciasis must be differentiated clinically form the following disease that produce similar manifestations.

Table 1. The clinical differential diagnoses of onchocercal skin disease

Main differential Diagnosis	**Distinguishing features and Remarks**
Miliaria	Miliaria-heat rash , uniform fine papules mostly on trunk Acute popular onchodermatitis(APOD) vesicles are larger and more wide scattered over the trunk whereas in miliaria are usually limited to flexural sites.
Bites of Simulium and other insects (papular urticaria)	These papules are small; closely clustered and many have a tangential punctum.
Scabies –parasitic disease caused by Sarcopetes scabie	Involvement of extremities and presence of burrows indicate SCABIES. Examine other family members.
Eczema –recurrent itching, erythema, edema, oozing and crusting lesions	Eczema –recurrent itching, erythema, edema, oozing and crusting lesions Eczema per se is rarely limited to the buttocks, the commonest site for Chronic popular onchodermatitis(CPOD) The flat-topped papules of CPOD are characteristic.
Lichenified eczema –recurrent oozing lesion Lichenification secondary to chronic scabies-interdigital lesions	Lichenified eczema –recurrent oozing lesion Lichenification secondary to chronic scabies are interdigital lesions Eczema and scabies usually have a symmetrical distribution unlike LOD which may be strikingly limited to one limb. The lichenification of Lichenified Onchodermatitis (LOD) is usually more confluent.
Senile atrophy	Senile atrophy- thinning of skin with loss of skin marking Atrophy associated with old age is usually generalized where as onchocercal atrophy may be limited to one site e.g. buttocks,

	resemble onchoceracal atrophy for patients less than 50 years old.
Other post-inflammatory/post-traumatic hypopignentation	The shins are a common site for trauma; resemble onchocercal depigmentation for confluent patches of depigmentation surrounding "spots" of normally pigmented skin.

2.9. Diagnosis

A presumptive diagnosis can be made based on a history of exposure in an endemic area, the presence of subcutaneous nodules, or typical skin and ocular signs.

B. Skin snip: Identification of microfilariae in skin snips or of the adult worms from excised or aspirated nodules confirms the diagnosis.

C. DEC patch test

A mixture of 10% DEC and Nivea cream is applied under an occlusive dressing; the occurrence of a localized inflammatory response indicates a positive test result.

2.10 Case Management

Goal:

- ✓ Prevent complication
- ✓ Alleviate symptoms

Pharmacologic treatment

Ivermectin is the drug of choice. Ivermectin is well-tolerated and highly effective microfilaricidal drug that rapidly reduces microfilarial numbers in the skin. Treatment with ivermectin decreases transmission, improves dermatitis, and decreases prevalence of blindness. Because it does not kill or sterilize adult worms treatment to suppress dermal

microfilarial levels must be repeated at annual or semiannual intervals for the duration of the lives of adult worms, which may be as long as 13 to 14 years.

Additional treatment

- Control itching with antihistamines
- Keratolytic preparations to resolve lichenfication
- Emollients to prevent dryness of skin
- Antibiotics for secondary bacterial infection

Surgical Care: Removal of all subcutaneous nodules can be curative; however, many nodules are difficult to find. And in conditions where lymphedema and elephantiasis develop, the redundant fibrous tissue can be removed surgically.

2.11. Prevention and control

The primary objective of onchocerciasis control strategies is to reduce community microfilarial burdens to levels that are associated with negligible morbidity. The major control strategies for onchocerciasis is through:

- ✓ Vector control using larvicides to reduce the black fly population. This method of control is expensive and difficult to administer over remote areas.
- ✓ Mass treatment with ivermectin is employed in areas of high endemicity and has successfully reduced the morbidity associated with onchocerciasis in treated populations by reducing the microfilarial burden.
- ✓ Education of people in endemic areas is a crucial aspect of lowering the transmission rate

2.12. Prognosis:

- Patients undergoing ivermectin treatment every 6-12 months for the lifetime of the adult worm (approximately 12 y) have resolution of early, reversible lesions and most eye findings and most dermatitis

- Patients with scarring of the cornea, chorioretinitis, blindness, skin atrophy, and depigmentation do not improve with treatment.
- Patients who are blind have an increased mortality rate and a shortened life expectancy.

2.13. Case study

"This itching is going to kill me!"

Aba Temam Aba Gidi, a 20 year-old farmer from Yebu, scratched and scratched, but he just couldn't get relief from the itching sensation he felt in his lower leg. He never had this problem before, and as far as he could remember, he had done nothing to his leg, no injuries, no paste put on it or the like. At first, the itching had not been very strong, but recently it had gotten much worse, so now he even used rough objects to scratch himself.

The other problem was that it now involved a much wider area: it had extended from the left lower leg to the thigh and gluteal area and finally to the right side. When he looked at it, he saw that the skin at these parts had become somewhat thicker and darker.

Aba Temam started to get worried that it might be something serious, so he went to the traditional healer. The healer gave him some local drugs which Aba Temam dutifully applied, but nevertheless, the problem got worse.

Group Exercise 1

1.1. List the problems this patient is having.

1.2. Discuss the possible differential diagnoses.

After he had this problem for almost two years, Aba Temam, complained about his skin problem to his friend. His friend said “You know, the local drugs don’t help at all! well, may be you should go and see a medical doctor. Jimma is close by; why don’t you go there?”

Aba Temam thought about this for some time; after a week he decided that his friend was probably right and came to the Department of Dermatology at Jimma University Specialized Hospital.

The attending dermatologist recorded in the chart:

Localised, pigmented plaque lesions with pigmented, oedematous and thickened skin on the left leg, thigh and gluteal area combined with few papules and a solitary lesion around the knee; mild pigmentation and thickening of skin on the right leg.

Having a pretty firm suspicion about the underlying disease (but not being quite sure about the possible differentials), the physician sent her patient for appropriate tests.

Group Exercise 2

2.1. What other examinations would you do?

2.2. What are the appropriate tests?

Aba Temam was told to go to the laboratory, where a skin snip was done.
On the paper the lab technician had given him, the Dermatologist could read:
Multiple microfilariae from left leg lesion.

Therefore, the diagnosis of onchocerciasis was confirmed.
The physician prescribed him tablets, some lotions and gave him advice.
Aba Temam thanked the physician and he was glad that finally something could be done against the itching...

Group Exercise 3

Based on the case history given above, try to answer the following questions.

1. What do you think is the mode of transmission of the disease?
2. In which parts of the country is the disease common?
3. How do you treat this patient?
4. Discuss the prevention measures.

UNIT THREE

SATELLITE MODULE FOR HEALTH OFFICERS

3.1. Introduction

3.1.1. Purpose

This satellite module is prepared for the health officer category. The module emphasizes areas not covered by the core module that are of particular concern to the health officer.

3.1.2. Directions

- After the pre-test go through the satellite module
- Readers are advised to refer to the core module whenever indicated.
- After completing the satellite module retake and answer all the pretest questions under section 3.2.
- Compare your results with that of the previous pretest taken

3.2. Pre-test for Health Officers

1. The average incubation period of onchocerciasis is_____.

2. How can you differentiate onchocerciasis from other disease that manifest with skin lesions?

3. Define onchocercomata.

4. Describe onchocercal lesions in the anterior and posterior segments of the eye.

5. Skin manifestations of onchocerciasis do not include:-

   A. Acute papular dermatitis

   B. Chronic papular dermatitis

C. Depigmentation

D. Bulae

6. The suitable breeding site for onchocerca volvulus is

A. Well oxygenated running water

B. Lakes and ponds

C. Stagnant water

D. waste matter

7. The drug of choice for onchocerciasis is ivermectin.

A. True B. False

8. Actions to prevent onchocerciasis include all of the following <u>except:</u>

A. Mass treatment in endemic areas

B. Larviciding C. Distribution of bed net D. Educating the people

3.3. Learning Objectives

After completing this module the reader will be able to:

1. Describe the life cycle of onchocerca volvulus.

2. Describe the burden of the disease in Ethiopia.

3. Describe the clinical features and identify suspected cases of onchocerciasis

4. Mention the possible complications of onchocerciasis

5. Describe the laboratory procedures to diagnose onchocerciasis

6. Mention and apply treatment modalities for onchocerciasis

3.4. Pathophysiology

The classic lesion of onchocerciasis is the onchocercoma, a firm, painless nodule in the subcutaneous tissue. Onchocercomata are formed predominantly on the head, face, and torso, but they may be found on the pelvic girdle and lower extremities deep-seated against the bones or near the joints. The nodule usually is composed of 2-3 females, male worms and daughter microfilariae encapsulated in a fibrous coat. Dead worms may calcify within the nodules.

The fertilized female worms which are living in the subcutaneous nodule release thousands of microfilariae that migrate through the lymphatic vessels to skin, eye and othertissues.Intraocular organisms are evident early in the disease by direct invasion from the conjunctiva, through the sclera, or through the cornea.

Most microfilariae die as immature worms in the host. Their death causes an intense inflammatory reaction that is responsible for most of the clinical manifestation of onchocerciasis. Antigens of the infective larvae seem to induce cell-mediated and humoral responses. Circulating immune complexes have been identified and implicated in the inflammatory response to infection. Perivascular deposits of immune complexes have been shown in various tissues. Immunoglobulin E (IgE) levels are also very high, thus implicating all of the known mechanisms of pathologic immune destruction. The lymph nodes that drain infected areas show granulomatous inflammation, fibrosis, and atrophy on histologic examination.

3.5. Clinical Features

Onchocerciasis is a chronic infection with clinical manifestations that develop years after the initial infection. The initial bite of the black fly tends to go unnoticed. A 1- to 2-year latent period after initial exposure is typical as the infective larvae migrate and develop into adult worms.

The earliest and most troublesome symptom of onchocerciasis is itching. Up to 50% of infected patients may complain of itching, which may be severe. Itching is most severe

over the sites of highest microfilarial infection, generally over the lower trunk, pelvis, buttocks, and thighs. The itching is associated with papular, pustular and lichenified lesion at the predilection sites.

Other symptoms are subcutaneous nodules, lymphadenopathy, visual changes (can range from mild to frank blindness) and weight loss.

Physical findings include skin, soft tissue, and eye abnormalities.

- Skin disease

The skin changes attributable to onchocerciasis have been graded in a relatively simple classification system consisting of acute papular onchodermatitis (APOD), chronic papular onchodermatitis (CPOD), lichenified onchodermatitis (LOD), atrophy, and depigmentation. More than one skin disease type can coexist in one patient.

Acute papular onchodermatitis consists of small, widely scattered pruritic papules that may progress to vesicles and pustules in more severe cases. Erythema and edema of the skin may be present, affecting a single limb or area of the trunk or face. Because of pruritus, these lesions may be associated with excoriations, secondary infection, and ulceration. APOD is the typical presentation in patients with short exposure histories. In such patients, microfilariae may be undetectable.

Chronic papular onchodermatitis consists of flat-topped papules that vary greatly in size (upto 1 cm) and on the skin surface (some lesions may be macular (flat); others are elevated up to 5 mm). Itching may occur but is variable. Patients with CPOD may also have acute lesions.

Lichenified onchodermatitis typically affects young adults and is characterized by pruritic, hyperpigmented, hyperkeratotic plaques. The distribution is usually asymmetrical, may involve one limb, and is associated with regional lymphadenopathy. In later stages, the skin is grossly lichenified, but in some patients may resolve with or without treatment. Itching is very intense in the acute stage. This condition may coexist with APOD or CPOD. Dermal microfilariae tend to be absent or scanty and are found only in the affected area.

Atrophy of the skin is relatively common in highly endemic areas. Atrophic skin adopts many of the characteristics of aging such as loss of elasticity and contours; the skin appears excessively wrinkled and is often very thin. There may be hair loss and reduced sweating.

Onchocercal depigmentation or 'leopard skin' is associated with patches of complete pigment loss that generally affect the lower leg anteriorly but may be observed anywhere on the body.

- **Soft tissue changes**

- *Nodules and adult worms (Onchocercomata)*

Onchocercomata are subcutaneous fibrous nodules containing adult worms, and can occur anywhere in the body but most palpable in the region of the iliac crest, the trochanter, the sacrum, the upper thorax, and head. Nodules are often absent among patients with short exposure histories but may become detectable later in the course of the infection.

- *Lymph nodes*

Acute regional lymphadenopathy may accompany acute papular eruptions and lymphedema. A rare manifestation of onchocercal lymph node involvement is 'hanging groin' or 'adenolymphocele' that is observed only in heavy and long-standing infections, and consists of a pouch of lymphoedematous tissue in which atrophic inguinal or femoral nodes hang .Inflammatory damage to the lymph nodes and lymphatics may lead to elephantiasis of the limbs or genitalia.

- **Eye disease**

- *Anterior segment*

Invasion of the skin and subcutaneous tissues around the eye eventually leads to the appearance of microfilariae in the eye and the development of lesions in the anterior segment leading to punctate keratitis, sclerosing keratitis, and uveitis.

Punctate keratitis is opacities of the superficial corneal stroma. They can be seen by the naked eye or visualized using a slit lamp.

Anterior uveitis is due to invasion of the iris and ciliary body by microfilariae. These lesions may be asymptomatic or accompanied by redness of the eye chemosis, excessive lacrimation , pain and visual disturbance.

- *Posterior segment*

The posterior segment of the eye may be involved in chronic and heavy infections; causing inflammatory damage to the retina and optic nerve.

Chorioretinitis in onchocerciasis is a slowly progressive and insidious condition taking many years before visual loss is evident.

Post-neuritic optic atrophy is the lesion most commonly affecting the optic nerve and reflects previous episodes of active inflammation. Acute optic neuritis is observed rarely.

Other complications

- Nakalanga dwarfism from pituitary involvement
- Epilepsy (associated, but not a proven complication)
- Posttreatment arthritis and tenosynovitis
- Reproductive abnormalities (secondary amenorrhea, spontaneous abortion, and infertility).

3.6. Differential diagnoses (see the core module)

3.7. Diagnosis

A presumptive diagnosis can be made based on a history of exposure in an endemic area, the presence of subcutaneous nodules, or typical skin and ocular signs.

- Identification of microfilariae in skin snips or of the adult worms from excised or aspirated nodules confirms the diagnosis. A slit-lamp examination may show free-floating intraocular microfilariae.

➢ **Skin snip**

- The skin snip is a biopsy of a 1- to 2-mg sample down to the level of the dermal papillae without drawing blood. In a bloody biopsy, other filarial pathogens may contaminate the specimen.
- When performed for diagnosis, 6 samples are usually obtained: 1 from each scapula, iliac crest, and lateral calf. Specimens are placed in saline wells; within an hour, microfilariae may be observed under low-power microscopy. Negative skin snip results should be examined several times in the next 24 hours. In heavy infection, as many as 100 microfilariae may be found in 1 mg of skin.

- Subcutaneous nodules can be located by palpation.

- **DEC patch test**
- A mixture of 10% DEC and Nivea cream is applied under an occlusive dressing; the occurrence of a localized inflammatory response indicates a positive test result.
- Reported sensitivity is 30-80% and is mainly attributed to varying geographical distribution.
- This test is being reevaluated for use in children.

3.8. Treatment

Goal:

- Prevent complication
- Alleviate symptoms

Pharmacologic treatment

Ivermectin

Ivermectin is the drug of choice. Ivermectin is well-tolerated and highly effective microfilaricidal drug that rapidly reduces microfilarial numbers in the skin. Treatment with ivermectin decreases transmission, improves dermatitis, and decreases prevalence of blindness. Because it does not kill or sterilize adult worms treatment to suppress dermal microfilarial levels must be repeated at annual or semiannual intervals for the duration of the lives of adult worms, which may be as long as 13 to 14 years.

Standard dosage

150 µg/kg for one dose.

Contraindications

Conditions associated with an impaired blood-brain barrier because penetration into the central nervous system can cause lethargy, ataxia, tremors, and death.

Main drug interactions

None.

Main side effects

Ivermectin is generally well-tolerated. Main side effect is associated with relatively mild adverse reactions caused by microfilarial killing (the Mazzotti reaction) especially those with short exposure histories.

Caution is needed in those with a possible exposure history to loaisis as the death of *Loa loa* microfilariae may cause severe or fatal encephalitis.

Precautions

The drug is not approved for use in children weighing less than 15 kg, in pregnant women, and in mothers nursing 1-week old infants.

Suramin

The only macrofilaricidal drug not recommended for routine use in patients with onchocerciasis. Because of significant toxicity, it should be considered for use only in exceptional cases with medical supervision:

Additional treatments (see the core module**)**

Other treatments

Doxycycline

The use of doxycycline in combination with ivermectin results in long-term suppression of microfilaridermia and sterilization of adult *O. volvulus* female worms for up to 18 months.

Diethylcarbamazine

There is no useful therapeutic role for this drug in the treatment of onchocerciasis. Use care among patients with lymphatic filariasis who may also be infected with *O. volvulus*. Treatment with DEC of patients with onchocerciasis can result in severe systemic reactions (Mazzoti reaction) and irreversible damage to the posterior segment. For patients with *O. volvulus* infection and lymphatic filariasis, concomitant treatment with DEC and ivermectin in mass chemotherapy programs for LF in Africa is not recommended.

Surgical Care: Removal of all subcutaneous nodules can be curative; however, many nodules are difficult to find.

3.9. Prognosis:

- Patients undergoing ivermectin treatment every 6-12 months for the lifetime of the adult worm (approximately 12 y) have resolution of most eye findings and most dermatitis.
- Patients with chorioretinitis, blindness, skin atrophy, and depigmentation do not improve with treatment. Patients who are blind have an increased mortality rate and a 10-year life expectancy

UNIT FOUR

SATELLITE MODULE FOR BSc

PROFESSIONAL NURSES

4.1 Introduction

4.1.1 Purpose:

A number of communicable diseases cause significant disruption in social and health services. Onchocerciasis is a public health problem of villagers. It is not only a disease of public health importance but also a disease of very high socioeconomic significance.

It causes a great deal of personal suffering and is a major economic influence in Africa. The economic, health and social consequences of onchocerciasis are devastating. It debilitates the young adult male farmer who then cannot farm (work) or cannot care for their children or the young men leave heavily infected areas. The black fly breeds in rapidly flowing water along the most fertile banks of rivers and streams. Fertile riverbanks at endemic areas are abandoned for fear of contracting the disease and people move to less fertile grounds, disrupting a stable village economy. Those large tracts of fertile land are depopulated. Farming communities are regaining their lost land and people are again planting crops and reaping harvest when there is a proper onchocerciasis control program is present. Onchocerciasis is one of the skin diseases comprised in prevention and control program.

Nurses who are working at midlevel and lower level health care units lack references. Unfortunately the surveillance of onchocerciasis is still weak in lower health services.

By nursing assessment, diagnosis and intervention, the nurse will learn how to make positive changes in the community through health education, training Extension Package Health Worker, proper supervision and follow-up and record keeping and reporting. The purpose of this self-learning module is to provide the mid- level health professionals with the necessary knowledge and skills to competently care for the patient and community at large. The information contained in this module will benefit the health professionals working at lower health care level. By studying this module the Health Centre team should have knowledge and reliable information on morbidity, mortality and trends in

order to guide onchocerciasis control program. It is of course not intended to provide complete instruction, but intended for use as a guide. It needs to be supplemented by standard books and periodicals. The authors therefore encourage further reading to enrich your knowledge and maintain skills.

4.1.2 Directions for using this module: -

- Before reading this part, be sure you have completed the pre-test and the core module.
- Continue reading the satellite modules for diploma nurses and Extension Package Health Workers in order to supervise them properly.

4.2. Pre-Test

1) Onchocerciasis is transmitted by the vector _____that prefers to breed in _____:

2) One of the following is **NOT** the clinical picture of onchocerciasis

A. Skin lesions B. Eye lesion

C. Elephantiasis D. Hydrocel

3) The less toxic drug of choice which is used in community directed treatment to prevent blindness in onchocerciasis is

A. Diethylcarbamazine B. Hetrazan

C. Mass chemotherapy D. Ivemectin

4) Onchocerciasis diagnosis is confirmed by:

A. Blood film B. Urine examination

C. Skin snips D. Marked increase of eosinophilia

5) The common features of onchocerciasis and its consequences include the following except**:**

A) Blindness C) Dermatititis

B) Nodule D) Hemorrhage

6) Which one the following onchoserciasis drugs has nephrotoxic effect which should not be recommended in routine treatment is ?

A) Ivermectin C) Diethylcarbamazine

B) Suramin D) Mectizan

7) During training Extension Package Health Workers the professional nurse should focus on:

A)_____

B)_____

C)_____

D)_____

8) Some of the common therapeutic problems of ivermectine in the onchocerciasis control program are:

A) _____

B) _____

C)_____

D)_____

9) The present contraindications to ivermectin include:

A) _____

B) _____

C) _____

D)_____

10) Wearing garments made of woolen fabrics should be avoided. State the reasons

4.3 Learning Objectives:

After studying this module the public health nurse will be able to:

- Identify the nature and the diagnostic approach of onchocerciasis.
- Carry out nursing management.
- Explain the dose, mode of action, side effect and contraindication of the drugs.
- Implement methods of preventing and controlling onchocerciasis as indicated at national and local level.
- Measure performance, effectiveness and outcome of health services to onchocerciasis control program.

4.4. Some common features of onchocerciasis

Onchocerciasis or “river blindness” is a tissue parasite transmitted and spread by the bite of the vector small black fly similum. When the adult female worm release microscopic microfilarie in to the body the microfilariae cause continuous debilitating itching.

The following sign and symptoms have to be considered:

The disease in Ethiopia is mainly characterized as causing a wide spectrum of skin lesions ranging from intense itching to gross changes in elasticity resulting in hanging groin, lizard like skin appearance and color changes.

A) **Onchocercal dermatitis or skin atrophy**: which manifests

1. Skin conditions:

1.1 Early signs

- Persistent pruritis, erythema and edema of the skin.
- Papular, pustular, nodular or urticarial lesions on the back, thighs, buttocks, extensor surfaces of upper and lower limbs maybe confined to one anatomical region only.
- Subcutaneous nodules on the face, back, shoulder, hip or trunk onchocercomata (containing adult worms)

1.2 Late signs

- Lichenification (hyperpigmentation, thickingof the skin with increased skin markings)
- Lizard skin (dryness, roughness and scaling of the skin)
- Leopard skin (atrophy with depigmented and hyperpigmented lesions on lower limbs commonly peri-tibial area)
- Lymphedema (persistent swelling of leggs)
- Hanging groin (atrophy of the skin and redundant folds with enlarged inguinal lymphnodes)
- Atrophy of the skin (thining of the skin with loss of skin markings hanging skin folds seen around the buttocks)
- Redness and swelling of the skin resembling erysipelas rarely occur knownas Erysipelas delacosta

2. Eye involvement

2.1 Early signs

- Reduced vision
- Keratitis (redness dryness of eyes)
- Iridocyclis (redness around the cornea, photophobia and pain)
- Sclerosing keratitis (pain and haziness of cornea)

2.2 Late sign- the most severe effect of the disease includes visual impairment and blindness.

-Weight loss-which is not directly related to onchocerciasis but may be due to social and mental impacts related with the disease.

The microfilaria can cause eyesight damage and potential blindness when they enter the eyes.

Unlike reports from West Africa the rate of blindness from onchocerciasis is not that significant in Ethiopia. If not treated in a timely fashion, blindness occurs by the colonization of microfilariae in the eyes. However, blindness caused by onchocerciasis (river blindness) is rare before the age of 30.

Fig.4.1. Onchocerciasis and its consequences.

Professional nurses working at midlevel health care are based not only on knowledge of the physical causes and feature of onchocerciasis but also on socio-economic impact.

Personal effects of onchocerciasis; physical and social health problems include:

- Disability
- Change in life style
- Social isolation
- Financial cost or burden

4.4.1. Complication

- Nodule
- Hydrocele
- Secondary infection
- Blindness

4.4.2. Diagnosis of onchocerciasis parasitic disease is based on:

- History of travel
- Duration of stay in endemic area
- Characteristics of clinical sign and symptoms
- The use of appropriate laboratory test (skin snip) to confirm the clinical diagnosis.

For a patient undergoing skin snip: **N**urses should explain about skin snip test and send the patient for laboratory procedure. If there is a laboratory they have to perform the skin snip.

4.4.3. The three endemic foci areas in Ethiopia are:

- Kefa-Sheka and Bench Maji zone in south west
- Pawi –Metema in northwest. Having total population at risk of about 2.5 million. As far as duration of stay and low infection rate is concerned with an average of 9-10 years stay in endemic areas settled or working around the riverbanks would be enough to be infected with the disease.

4.5. Nursing Management andPrevention

4.5.1. Nursing Assessment, Diagnosis and intervention

Nurses should understand the nature of onchocerciasis, related factors and defining the characteristics of the problem and nursing diagnosis through proper assessment.

- Examine by removing all clothing.
- Check for the presence of nodules, atrophied and pigmented skin and pruritus to properly record the situation.
- Examine the scrotum properly by using torch
- Perform Proper visual test and record by using E-chart and define blindness corresponding to the inability to count finger at a distance of 3 meters.

4.5.2. Nursing Diagnosis:

- Anxiety related to skin disease and its appearance
- Anxiety related to nocturnal itching
- insomnia (loss of sleep) related to nocturnal itching
- Anxiety related to poor vision
- Altered in comfort; chronic pain related to the illness
- Ineffective coping ability with the problem
- Fear of family disruption related to the illness
- Impaired tissue integrity related to persistent and chronic itching as secondary to skin infection.
- Potential for complication (secondary to skin infection) related to continuous itching and scratch
- Anxiety related to psychosocial problem
- Knowledge deficit about the illness

4.5.3. Measures of prevention and control

- Onchocerciasis is a preventable disease.
- Control and prevention is better than cure in this disease.
- Preventing infection through primary prevention activities (vector control) and regular use of ivermectin is the most cost-effective public health strategy.

- Fighting onchocerciasis commonly known as river blindness is not only the responsibility of the health sectors alone, it should involve

multi-sectoral organization. Close collaboration with other sectors and the community, families, school children (who mostly play at the river side) is important.

- Professional nurses should combat onchocerciasis in coalition with different organizations working in control program by involving EPHW in community based and home based control program.
- Measures for prevention and control of onchocerciasis include:
  ii) Early diagnosis and treatment
  iii) Improved personal or environmental hygiene.
  iv) Effective vector control
  v) Community health education
- Onchocerciasis management can be addressed by:
  - Strengthening infrastructure
  - Training health workers in the community
- Annual treatment of endemic communities suffices to reduce the:
  - Parasite load
  - Prevent new cases of blindness
  - Improve anterior segment eye lesion
  - allevatesonchodermatitis

Weekly aerial application of larvicide to the breeding site of black flies has effectively interrupted the disease transmission. Because of the large surface of the river and springs application is difficult. There are few reports on the effectiveness of repellents against black fly.

4.5.4. Drug Treatment:

Nurses should understand whom to treat:

- Infected people who have left the endemic areas
- Those whose eyesight is becoming impaired.
- Those incapacitated by itching
- Those incapable of avoiding reinfection i.e. livingin endemic Area.

NB: Because of its sever side effect diethylcarbamazine (DEC) is not recommended.

4.5.4.1. Suramin: -

a) Is the only drug in current use capable of killing adult worms.
b) It is a toxic drug that nurses should be aware to identify and understand allergy to suramine which are:
    - Fever,
    - Urticaria,
    - Arthritis
    - Exfoliative dermatitis that can be controlled by corticosteroids:- predinsone is given in a dose of 20 mg three times daily, then the dose should be reduced gradually.

Its use requires close nursing supervision during administration.

Suramin must be freshly dissolved from powder immediately before use. Ordered dose (five doses) of 20mg/kg are given IV at weekly intervals. The drug is nephrotoxic (the nurse should collect urine specimen for test before each injection). **If protein and casts are present the drug should be withheld.**

4.5.3.2 Ivermectin:

a) The drug of choice to treat or combat river blindness without severe side effects is ivermectin (Mectizan). Ivermectin has been successfully used in treating onchocerciasis.
b) The most recent development in the prevention of blindness from onchoserciasis is ivermectin:- a non-toxic microfilaricide suitable also for large-scale or community based treatment. Nurses should understand this drug does not affect adult worms but a single oral dose once or twice each year kills the microfilariae, thus stopping the onset of blindness and the skin disease.
c) Nurses should understand the contraindication and possible side effects of giving ivermecitin.

Present contraindications to ivermectin include:

- Pregnant women
- Mothers in the first month of lactation
- Children under the age of five years
- Children under 15 kg body weight.
- Those severely ill

Since 1987, ivermectin is supplied free of charge in which the annual treatment is recommended at a dose of 150 microgram per kilogram of body weight. The ivermectin (Mectizan) treatment chart must be used.

Fig.4.2. Mectizan treatment chart.

Professional nurses working at mid-level should be aware about ivermectin distribution from production to community level which is one of the cornerstones for the control program sustainability for timely request and distribution.

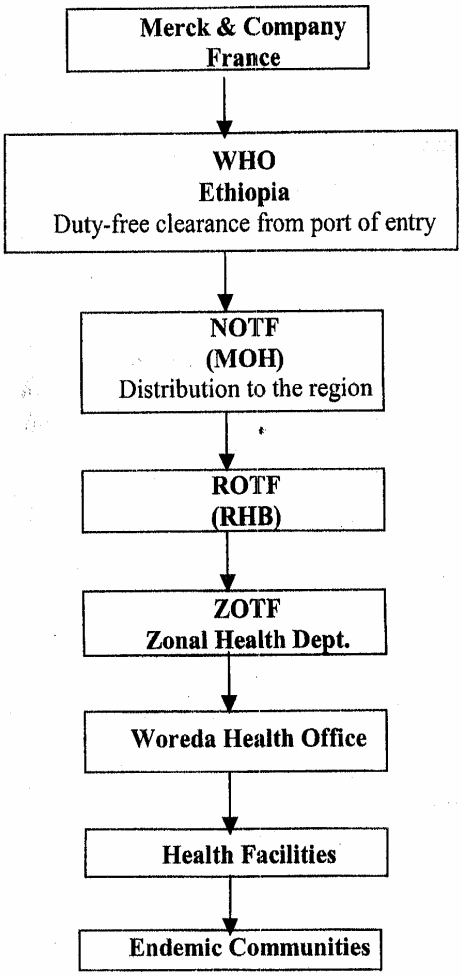


Figure 6 - Flow of Mectizan Importation & Distribution

Some of the common therapeutic problems of ivermectine in OCP are the:

- Muscular and joint pain, sever itching, fever, dizziness, vomiting, head ache, diarrhea, redness of the eye

Adequate, secure distribution mechanisms and health care infrastructure are essential in insuring ivermectin reach those who need them at all level.

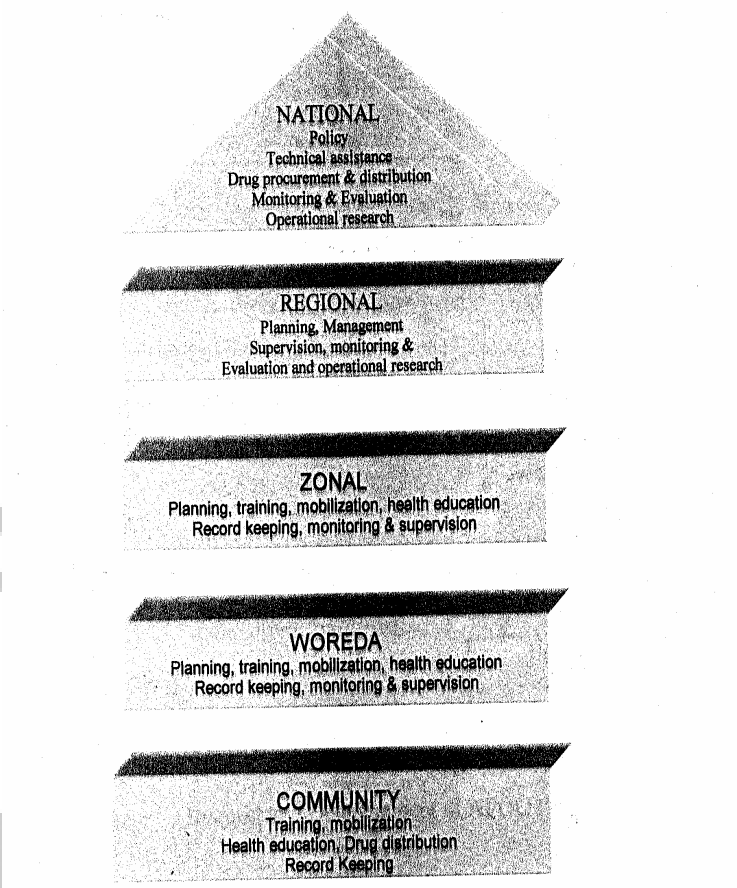


Figure 4 - Main activities of the Onchocerciasis Control Task Force at Various Levels

Fig 4-3 Main activities of the Onchoserciasis control Task Force at various level

4.5.4 Nursing intervention and supportive care

Problems that should be relieved by proper nursing care are:

- Sever itching (mostly in the night) and other aspects of skin manifestation having serious psychological and socioeconomic consequences that can never be underestimated. E.g. studies reveal that the skin manifestation of onchocerciasis to be more important than blindness, because of their effect on relation ship and marriage prospects.
- Loss of sleep that often leads to fatigue during the day which in turn results in low productivity and economic activities is a common occurrence in onchocerciasis affected communities.

- Moreover on top of the impoverishment and depressed life style, the social stigma and ostracization that each victim of onchocerciasis suffers is so enormous that of awareness creation is important.
- There are so many villages with fertile farmlands that were completely abandoned due to onchocerciasis.

- Proper Psychological support andreassurance including health education to patients, family and the community how to cope the problem for the reason it causes continuous itching and sleep disturbance.
- Campaigns for awareness creation should be conducted in all affected communities. Health education of the community and training of Health Extension package is part of information education and communication (IEC). Organizing training of trainers is also a focus area.
- Appropriate means of providing drugs. Nurses should give attention to immediate allergic reaction following the treatment andthey have to instruct the patient how to seek help.
- If surgery is planned, in cases of nodulectomy and hydrocele, patient preparation physically &psychologically is one of the nursing procedures.
- Where onchocerciasis is prevalent the itching skin makes the victim scratch a lot and the lesions become secondarily infected with streptococcus.

The hands of the patient are then constantly harbour the organism & its spread is facilitated.

- Frequent hand washing combined with keeping the fingernails cut short (rimmed), to prevent scratching which leads to secondary infection.
- The nurse should explain the importance of not scratching.

- Itchy rash is a common skin condition:

Nurses should identify the nature of the lesion to distinguish from other forms of skin disease, possible cause and treatment in short.

- Nursing management is aimed at relieving the situations that cause pruritus, decreasing the associated discomfort and preventing additional trauma secondary infection to the skin.

- Provide antihistamine andapply soothing lotion.
- Pruritus is often caused by excessive drying of skin especially in older patients i.e. the severity is highest in old persons if involved.

- To minimize migration of the microfilaria to the periphery the night clothes must be light.
- Dry skin is characteristically flaky and easily susceptible to injury and irritation.
- Bathing should be limited & bath less frequently, especially when the outdoor temperature and humidity are low.

If soap is used it should be thoroughly rinsed from the skin for the reason the residue soap left on the skin predisposes or causes irritation dryness and break down of the skin.

- Advice the patient to avoid wearing garments made of woolen fabrics since wool tends to irritate dry skin. Wash garments made of wrinkle-resistant fabrics once or twice before wearing them.
- Add moisture to the air through humidifier when the skin is dry.
- Increase fluid intake when the skin is dry.
- Use an emollient, which is an agent used to soften, soothe, and protect dry skin after it is cleansed. Emollient or moisturizing creams do not add moisture to the skin. Rather, the film they leave on the skin retards normal moisture evaporation and helps to hold down the scaly skin surfaces. Cocoa butter, petrolatum jelly and lanolin are effective emollients and are used in many emollient creams.
- Avoid defating agents, such as alcohol, on dry and easily injured skin.
- Oil may be added to the bath water, but care should be taken because oil makes the bath tub slippery.
- Lotions and moisturizing creams should be applied regularly to promote rehydration of dried areas.
- Involve the target communities in the decision making process from the initial stages of the program and throughout the various stages of the control program.
- Health education and promotion aimed at changing individual and community behaviour:
    - Teach specific vector control and personal protection measures

- Initiate school health program
- Initiate home visiting by diploma nurse and Extension Package Health Workers.

- Proper instruction & teaching to prevent accident due to poor vision.
- Supporting device is necessary when there is a problem of hydrocele.
- Involvement and Mobilizing community and intersectoral collaboration for participation is essential to successful implementation of OCP.
- A treatment plan must be according to the policy and approval by the Ministry Of Health.
- The ability to maintain required medical records and to report adverse reaction, communication and referral system need sufficient resources to be maintained to sustain the treatment programs for a minimum of five years.
- There must be an agreement to integrate ivermectin into the existing health system wherever possible for sustainability for the areas of that most programs rely on NGOs working in the areas blindness prevention.
- Home visit and implementation of Home based onchocercisis treatment should be initiated: discuss the mode of transmission and prevention with family members. Provide family-centered case management and health education.
- In service training for diploma nurses and Extension Package Health workers
- Environmental management aimed at vector control is mostly done by community itself through community mobilization.
- Training of Extention Package Health Workers for community directed distribution and treatment with ivermectin in the case of mass treatment. The training should focus on:
    - drug distribution
    - health education
    - community mobilization
    - record keeping

Attention should be given to strengthening onchocerciasis control program task forces at all level. The control program should be made clear to target communities and political leaders for sustainability of the control program.

4.5.5 Referral:

Nurses should refer patients with a module containing adult worm on the head region which is indicated because of increased risk of serious ocular disease. Degree nurses should instruct diploma nurses and Extension Package Health Workers, when to refer a patient to the next level of health care.

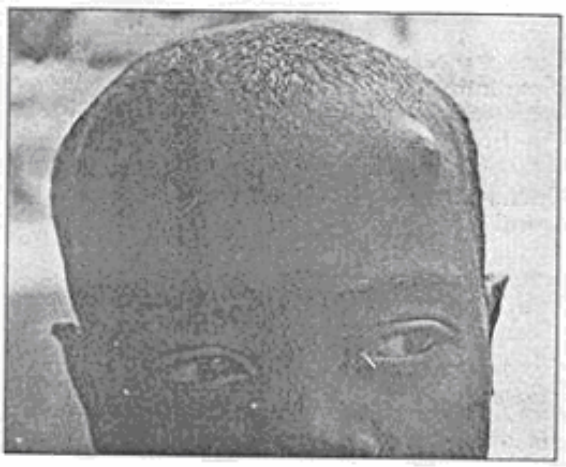


Fig. 4.4. Child with onchocercial nodule on head

Personal record sheet: -nurses should record age, sex, locality, birth place and duration of stay at present address for follow-up. If the care of onchocerciasis is to be effective and appropriate the professional nurse must have knowledge of the importance of socio cultural influences and specific control measure.

4.5.6 Summary:

Onchocerciasis prevention & control program must move beyond providing drug treatment. i.e. to include counseling to social & economic problems that arises due to the disease and its consequences. Effective control of onchoserciasis requires the use of multi system approach having Close cooperation with other members of interdisciplinary health care team focusing on improving safety of the environment, facilitating social and economical changes to ensure health for all people living in endemic areas.

Considering its awful consequences on public health and socio economic development nurses in close collaboration with the other sectors, families, affected communities school children other professionals, donors andinternational agencies & national control programs should fight this human scourage.

Are you through with the core and satellite module? If so read the modules of other categories. Check the pre-test and answers.

UNIT FIVE

SATELLITE MODULE

FOR BSc MEDICAL LBORATORY PERSONNEL

5.1 Introduction

5.1.1 Purpose:

This satellite module is planned to give pertinent and simple methods for laboratory diagnosis of O.volvulus.

5.1.2 Directions:

- Read the core module before starting this part.
- Attempt the pre-test before reading this part.

5.1.3 Pre-test for laboratory personnel.

There is only one correct choice for each question. Attempt all.

1. Early immature stage of filarial worm is called
    A. Amastigote
    B. Microfilariae
    C. Metacercaria
    D. All
2. O.Volvlus adult worms are located in
    A. Blood cells
    B. Skin nodules
    C. Small intestine
    D. A and B
3. In Giemsa stain preparation,microfilariae of O.Volvulus appears as.
    A. Hooked tail
    B. Tail with nuclei to the end.
    C. Globular head
    D. None

4. Serology test has not widely applied in diagnosis of onchocerciasis because
    A. The test Is costly
    B. Filarial worms are less antigenic
    C. Cross- reactivity
    D. All
5. Which is not site for skin snip
    A. skin from center of nodule
    B. buttock area
    C. skin over ribs
    D. None
6. Slide technique of skin snip preparation
    A. Gives more microfilaria yield
    B. Does not require physiological saline
    C. Gives poor microfilaria yield than tube method
    D. None
7. Which one is not used in differentiation of microfilarae of filarial worm
    A. Presence of absence of sheath
    B. Position of nuclei in the anterior part
    C. Tail nuclei arrangement
    D. Color of microfilariae.
8. Number of skin snips should be taken before issuing negative result.
    A. 2
    B. 4
    C. 6
    D. 8
9. Patient for skin snip examination for onchcerciasis should.
    A. sit for half an hour under direct sun light
    B. sit for half an hour under shed
    C. A and B
    D. All

10. Which one is not required for slide technique of skin snip preparation.

A. Slide
B. Centrifuge
C. Saline
D. Cover slip

5.1.4 Learning objectives

After reading the text, the laboratory personnel will be expected:

- To demonstrate laboratory techniques for diagnosis of onchocerca volvulus.
- To identify features of microfilariae in skin snip preparation.
- To describe and apply Giemsa staining procedure for species identification of filarial worms.
- To list advance laboratory techniques for Onchocerca volvulus diagnosis.

5.2. Diagnosis of onchoceciasis

O. volvulus is one of various filarial worms that cause disease of human beings. Filarial worms belong to phylum Aschelminthes, class Nematoda and sub family filarioidea.

General features of tissue nematodes that infect human:

- Adult worm (according to species) live in the lymphatic, sub-cutaneous tissue, connective tissue, muscle or body cavities.
- Females are viviparous
- Human is the only most significant host except T. spiralis.
- Transmitted by insect bit except T,Spiralis.

Tissue nematode of medical importance includes:

- Wuchereria bancrofti
- Brugia malayi
- Loa loa
- Onchocerca volvulus.

Methods of laboratory diagnosis

- Parasitological /skin snip/ method.
- Provocative test method
  - – Mazzottie reaction.
  - Patch test
- Serological test methods
- Nucleic acid amplification method

5.2.1 Parasitological test /skin snip test /

It is the most useful diagnostic procedure. It is bases on finding O. volvulus microfilariae in the skin snips. The natural habitats of the larval are connective tissue and cutaneous layers in the vicinity of the parent worm, as well as in the stratum germinativum and the corneal conjunctiva.

Bloodless skin snip should be taken after a patient has rested away from direct sun light for half an hour.

5.2.1.1. Where to collect specimen

A) Patients with nodules

Look for nodules:

- On the chest (over the ribs)
- On the hips
- One the legs (tibia)
- On the back (shoulder blades)

➢ Take the specimen from the skin in the center of the nodule.

B) Patients without nodules

Take specimens from

- The top of the buttocks (the upper outer part where intramuscular injections are given)

If the examination gives negative result, take specimen from:-

- The calf (upper outer part)
- The back (center of shoulderblade)

It is recommended that 6 specimens (2 from buttocks, 2 from calves, and 2 from shoulderblades) be examined before reporting a negative result.

5.2.1.2. Test principle

Two to six skin snips are taken from an area of maximum microfilarial density. Biopsy specimens are placed in normal saline on a slide or in a test tube for a length of time. The saline is then examined for microfilariae that migrate from the tissue. If no microfilariae are seen, the preparation should be left overnight and examined for microfiliariae the next morning.

There are two types of skin snip techniques. These are

- Slide technique
- Test tube technique

Tube method is a more reliable technique. It is recommended in areas where onchocericiasis is less endemic. Is also used to confirm negative results with slide technique results.

5.2.1.3. Slide technique procedure

Materials Needed:

- Sterile needle
- Sterile razor (scalpel)
- Spirit swab.
- Slide
- Cover slip
- Microscope (10X)

Procedure

1. Cleanse the skin using a sprit swab. Allow the area to dry.
2. Insert a sterile fine needle almost horizontally into the skin and raise the point of the needle, lifting with it a small piece of skin measuring about 2mm in length and diameter.
3. Cut off the piece of skin with a sterile razor blade

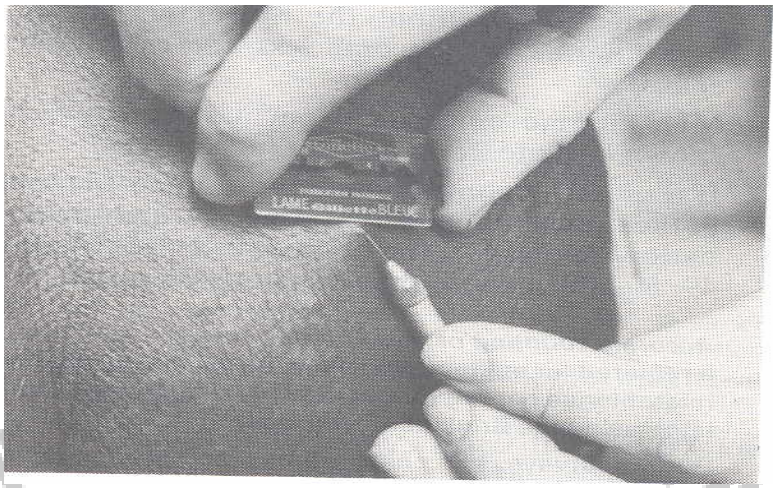


Fig.5.1. Procedure of skin snip taking

4. Immerse the skin snip in physiological saline on slide. Water can be used but the microfilaria take longer to emerge from the skin.
5. Cover the preparation with cover glass. Place the slide or tray on a piece of damp tissue in a Petri dish or plastic box to prevent the preparation from drying.
6. Incubate the preparation at room temperature for a length of time needed for microfilariae to emerge. As a rule an overnight incubation period should be allowed before recording a negative test. In practice most workers look at the preparation after 5 minutes of being incubated and if no microfilaria is detected, again at 15 minutes intervals for 1 hour. If no microfilaria is seen, the preparation should be left overnight and examined the following day.
7. Examine the preparation microscopically for actively motile microfilariae using 10 x objective. With prolonged incubation movement of the microfilariae will be come less and eventually cease.

5.2.1.4. Test tube technique

Materials:

In addition to the above mentioned materials this technique requires:

- Centrifuge tube
- Centrifuge
- Forceps

Procedures

1. Immerse the skin snip in 2ml of physiological saline in a centrifuge tube. Incubate at room temperature over night.
2. Using forceps, remove the skin snip, place it on a slide, and cover with a cover glass.
3. Centrifuge the contents of the tube at a medium speed (approximately 2000 RPM) for 5-10 minutes. Remove or discard the supernatant fluid. Transfer the entire sediment to a slide.
4. Examine the skin and the sediment microscopically for a microfilaiae using 10 x objective with the condenser iris closed sufficiently to give good contrast

NB: - The microfilaria from skin snips appear colorless, transparent, and actively motile and non periodic.

5.2.1.5. Species confirmation of microfllariae of filarial worms

Microfilaria of filarial worms differ from one another on the bases of in their: -

- Size
- Presence or absence of sheath
- Distribution of nuclei at in the caudal Region of the Larvae.
- Periodicity of their appearance in the blood.
- And location of microfilariae

Giemsa stained preparation of microfilariae is examined microscopically using oil imersion objective for species confirmation.

Giemsa staining procedure:

1. Remove the cover glass and allow the preparation to dry completely.
2. Fix the dried preparation with absolute methanol or ethanol for 2-3 minutes.
3. Cover it with 10% Giemsa staining solution
4. After 30 minutes wash off the stain with tap water and allow it to dry.
5. Examine the stained slide using oil immersion- Objective.

5.2.1.6.Features of O.volvulus Microfilariae under Giemsa stain.

- Size – large: measures 240-360 x 5-9 µm
- Has no sheath
- Has pointed tail without nuclei
- Has globular head.
- Anterior nuclei positioned side by side.

Fig O. volvulus, Microfilaria (unsheathed).

Table- Morphological feature of O. Volvulus microfilariae, which aid in differential diagnosis form other filarial warm larvae found in the skin.

Spaces	Size	Sheath	Body & tail	Other points
O.volvulus	Large & thick 240-300 x 5-9 mm	No	Head is slightly enlarged. Anterior nuclei positioned side by side. There are no nuclei in the end of the tail which is long and pointed.	Differentiation is easy from M. streptocerca, but more difficult from M. 033ardi

M.streptocerca	Small & thin 180-240 x 4.5 mm	-	Anterior nuclei are positioned in a single file. Nuclei extend to the end of the tail, which is rounded, and usually hooked.	Differentiation is from O.volvulus is by its smaller size, single file anterior nuclei & tail feature.
M. ozzardi	Small & thin 150-200x 4.5 mm	-	Anterior nuclei are positioned side by side. There are no nuclei in the end of the tail, which is long & pointed.	Differentiated from O. volvulus mainly by its smaller size and different shaped head.

Demonstration of adult worm inside the excised nodule can also be a diagnostic method. Features of Onchocerca volvulus adult worm are: -

- Location – Nodules of subcutaneous tissue
- Size – male – 1.9 – 4.2cm by 0.13 –0.21mm.
  - Female – much longer than male, measures 33.5 –50cm by 0.27 – 0.40mm
- Appearance – white, opalescent & transparent with transverse striation on the cuticle.

Note – during heavy infection microfilariae can also found in urine, blood, and other body fluids.

5.2.2. Provocative test methods

This method depends on the body's allergic response to destroyed microfllariae by diethylcarbamizine (DEC).

5.2.2.1. Mazzotti reaction

Test principle**:**

A dose of 50 mg of DEC is given and usually followed 15-30 minutes, or occasionally hours later by intense itching and erythema caused by allergic reaction to the destroyed microfilaria. This implies a positive test result.

The method is not popular because the response is very intense in heavily infected individuals such that it may result in collapse, shortness of birth, coughing and vertigo. To minimize this it is advisable to provide smaller doses (10-20mg) for patients from endemic area. Or restrict the test for a patient with negative skin snip test result.

5.2.2.2. Patch test

Principle of the test:

The test involves applying topically a small amount of 10% DEC in Nivea lanolin cream to an area of skin about 5mm in diameter and covering the area with a dressing. The area is inspected 8, 12, 12, 48 and 72 hours later. A positive test is shown by a papular eruption developing 8-24 hours after applying DEC. The

Patch test is simple, sensitive and has only limited itching thus; it can be used in countries where onchocerciasisis is endemic.

Test preparation:

Dissolve 10 gm DEC in 100 ml Nivia milk (Nivia skin cream) and store on ice. Patches are prepared by soaking 3 cm by 2 cm. Filter paper in the 10% DEC Nivia cream solution. Apply the patches on the body preferably on the above mentioned body area where microfilariae are in high density.

5.2.3. Immuno diagnosis

- Current serological tests use blots of finger-prick blood collected on filter paper.
- Reported sensitively is 70-80%, and specificity is 96-100%
- Serological diagnosis cannot reliably distinguish past infection from current infection.

5.2.4. Nucleic acid amplification tests

- Assays based on polymerase chain reaction (PCR) are highly effective in diagnosis of onchoceriasis, although cost and technical issues keep this from routine use.
- PCR based assays may also be used to detect infection in black fly vectors.

5.2.5. Examination of other body fluids

- Microfilariae have been found in urine and cerebrospinal fluid (CSF) of some infected individuals in hyper endemic areas.
- Pretreatment with small dose of DEC mobilizes microfilriae to the urine. Microfilariae may then be observed on microscopic examination. Urine examination is not a diagnostic substitute for skin snips.
- In high level parasitemia , mirofilariae may be observed in the CSF.

UNIT SIX

SATELLITE MODULE FOR

ENVIRONMENTAL HEALTH OFFICERS

6.1. Introduction

6.1.1. Purpose and use of this satellite module

This module is intended to be used by environmental health officers and provide them with basic information that are not discussed in the core module but basic to undertake prevention and control activities.

6.1.2. Directions for using the module

- Before reading this satellite module be sure that you have completed the pre-test and studied the core module.
- Continue reading this satellite module.

6.1.3. Pre-test for environmental health technicians

1. One of the following statements is wrong
    a) Because of the feeding and metabolic requirements of the black fly larvae, eggs are laid in well-oxygenated waters.
    b) O.volvulus can only be transmitted by black flies of the genus Simulium
    c) It is only the female black fly that bite humans
    d) Transmission of onchocerciasis usually occurs close to black fly breeding sites in fast following rivers, giving rise to the apt term 'river blindness' for this disease.
    e) None
2. The best practical method at present available for the control of black flies is:
    a) Insecticide spraying of vegetation thought to harbour resting adult flies
    b) Environmental management
    c) Weekly application of insecticides to their breeding places to kill the larvae
    d) Personal protection measures

3. Select the correct statement

   a) The ultimate goal of African Program for Onchcerciasis Control (APOC) and thus Ethiopian Program for Onchocerciasis Control (EPOC) is to eliminate onchocerciasis as a disease of public health and socio-economic development importance.
   b) The main control approach employed by EPOC is control of the disease by establishing community-directed treatment with the drug ivermectin (CDTI), supplemented with vector eradication in a few isolated foci.
   c) To eliminate the vector and hence the disease is one of the objective of APOC and EPOC.
   d) All

4. Personal protection measures to prevent from being bitten by black flies include
   a) Proper clothing
   b) Insect repellents
   c) Avoiding washing of the body in fast flowing streams or rivers
   d) A and B
   e) All

5. Select the false statement about black flies
   a) Adult Black flies are quite small
   b) The wings of black fly are colorless or almost so
   c) The wings are short and broad
   d) Black flies have humped thorax
   e) None

6. Vector Control of black flies needs the knowledge of:
   a) Breeding sites
   b) Dispersal potential /flight range
   c) Resting place
   d) Life cycle of the vector species
   e) A and C
   f) All

7. Adult populations of black flies are difficult to control because of
    a) Insecticide resistance
    b) Broad dispersal potential
    c) The wide variety of resting places
    d) All except A
    e) All
8. Insecticides that are used for large-scale campaigns in the prevention and control of black flies must be
        a) Highly effective against the vector
        b) Safe for the environment
        c) Broad spectrum
        d) All
        e) e) All except C
9. Describe the goal, objectives and strategy of APOC and EPOC?
10. Define and describe the monthly and annual biting potential of the vector?
11. Describe monthly and annual transmission rate of onchocerciasis?
12. Explain the importance of adult fly survey and immature stage survey?

6.2. Learning objective

After reading this module the learner will be able to:

√ Describe the life cycle of black fly

√ Identify adult black fly and immature stages (especially larvae)

√ Describe adult black fly behaviors that are very important in the prevention and control of black flies

√ Give training to environmental health technicians and primary health workers

√ Organize and mobilize onchocerciasis control programme

√ Evaluate effectiveness of control measures

√ Conduct scientific research on onchocerciasis

6.3. Black flies (Simuliidae)

Simuliidae are in the class insecta and order diptera. Black flies have a worldwide distribution with the exception of a few islands. There are nearly 1720 species in 26 genera. However, only four genera Simulium, Prosimulium, Austrosimulium and Cnephia contain species that bite people.

Medically, Simulium is by far the most important genus as it contains many vectors. In Africa, species in the S. damnosum complex and S. neavei groups and in Central and South America, species in the S. achraceum, S. metallicum and S.exiguum complexes transmit the parasitic nematode Onchocercia volvulus which cause human onchocerciasis (river blindness).

6.3.1. External morphology

The Simuliidae are commonly known as black flies. But in some areas, in particular Australia, they may be called sand flies. As this terminology is confusing because of biting flies of the family ceratopogonidae, and flies of the subfamily phylebotominae, which also sometimes called sand flies, it best be avoided. Adult black flies are quite small, about 1.5-4mm long, relatively stout bodied and, when viewed from the side, have a rather humped thorax (see figure 1). As their vernacular name indicates they are usually black in color but many have contrasting patterns of white, silvery or yellowish hairs on their bodies and legs, and others may be predominantly or largely orange or bright yellow.

Black flies have a pair of compound eyes, which in females are separated on the top of the head (a condition known as dichoptic); in the males the eyes occupy almost all of the head, and touch on top of it and in front above the bases of the antennae (a condition known as holoptic). In the males, but not females, the small lenses are larger on the upper than lower half of the eyes. The antennae are short, stout, cylindrical and distinctly segmented (usually 11 segments) but without long hairs.

The mouthparts are short and relatively inconspicuous but the five-segmented maxillary palps, which arise at their base, hang downwards and are easily seen. The mouthparts, being short and broad, do not penetrate very deeply into the host's tissues. Teeth on the labrum stretch the skin, while the rasp-like action of the maxillae and mandibles cuts

through it and ruptures the fine blood capillaries. The flies then suck up the small pool of blood produced. This method of feeding is ideally suited for picking up the microfilariae of O. volvulus, which occur in human skin not blood.

The thorax is covered dorsally with very fine and appressed hairs, which can be black, white, silvery, yellow or orange and may be arranged in various patterns. The relatively short legs are also covered with very fine and closely appressed hairs and may be unicolors or have contrasting bands of pale and dark color.

The wings are characteristically short and broad and lack scales and prominent hairs. Only the veins near the anterior margin are well developed; the rest of the wing is membranous and has an indistinct venation. The wings are colorless or almost so. When at rest the wings are closed over the body like the blades of a closed pair of scissors.

The abdomen is short and squat, and covered with inconspicuous closely appressed fine hairs. The genitalia are not conspicuous in either sex. Black flies are most easily sexed by looking at the eyes.

6.3.2. Life cycle

Black flies breed in flowing water but the type of breeding place differs greatly according to species. Breeding habitat can very from small trickles of water, slow flowing streams, lake outlets and water flowing from dams to fast flowing rivers and rapids.

When first laid the eggs are pale and often whitish but darken to a brown or black colour. They are about 0.1-0.4 mm long, more or less triangular in shape but with rounded corners and have smooth unsculptured shells (fig 2.a). Usually 150-800 eggs per female are deposited in sticky masses or strings on a level with, or just below the water surface, on aquatic plants, or on logs, water-splashed rocks, or other solid surfaces in or at the edge of the water. Commonly the female drops eggs while flying over the water surface; some species will hover and oviposite through a thin film of water that covers sand, rock, or vegetation; others will settle and oviposite on water-lapped surfaces at the water's edge. There may be a few favored oviposition sites in a stream or river, resulting in thousands of eggs from many females being found together. Simulium damnosum, for example, frequently has such communal oviposition sites.

Eggs of S. damnosum hatch with in about 1-2 days but in many other tropical species the egg stage lasts 2-4 days. Eggs of some species inhabiting temperate and cold northern areas may not hatch for many weeks and some species pass the winter as diapausing eggs.

There are six to nine (usually seven) larval instars and the mature larvae is about 4-12 mm long, depending on the species, and is easily distinguished from all other aquatic larvae. The head is usually black, or almost so, and has a prominent pairs of feeding brushes, while the weekly segmented, cylindrical body is usually grayish, but may be darker or some times even greenish. The body is slightly swollen beyond the head and in most, but not all species, distinctly swollen towards the end. The rectum has fingerlike rectal organs, which on larval preservation may be extruded and visible as a protuberance from the dorsal surface towards the end of the abdomen. Ventrally, just below the head, is a small pseudopod called the proleg, which is armed with a small circlet of hook lets.

Larvae do not swim but remain sedentary for long periods on submerged vegetation, rocks, stones and other debris. Attachment is achieved by the posterior hook-circlet (caudal/anal sucker) tightly gripping a small silken pad. This is produced by the larva's very large salivary glands and is firmly glued to the substrate. Larvae can nevertheless move about and change their position. This is achieved by alternatively attaching themselves to the substrate by the proleg and the posterior hook-circlet, thus they move in a looping manner. When larvae are disturbed they can deposit sticky saliva on a submerged object, release their hold and be swept down stream for some distance at the end of a silken thread. They can then either swallow the thread of saliva and regain their original position, or reattach themselves at sites further downstream. Larvae usually orient themselves to lie parallel to the flow of water with their head downstream. They are mainly filter feeders, ingesting, with the aid of large mouth brushes, suspended particles of food. However, a few species have predacious larvae and others are occasionally cannibalistic. Larval development may be as short as 6-12 days depending on species and temperature, but in some species may be extended to several months, and other species larvae overwinter.

Mature larvae, which can be recognized by a blackish mark termed the gill spot (the respiratory organ of the future pupa) on each side of the thorax, (figure 2) spin, with the silk

produced by the salivary glands, a protective slipper-shaped brownish cocoon. This cocoon is firmly stuck to submerged vegetation, rocks or other objects and its shape and structure vary greatly according to species. After weaving the cocoon the enclosed larvae pupates. The pupa has a pair of usually prominent, filamentous or broad thin-walled, respiratory gills (see figure 3). Their length, shape and the number of filaments or branches provide useful taxonomic characters for species identification. These gills, and the anterior part of the pupa, often project from the entrance of the cocoon. In both tropical and non-tropical countries pupal period lasts only 2-6 days, and is unusual in not appearing to be dependant on temperature.

On emergence adults either rise rapidly to the water surface in a protective bubble of gas, which prevents them from being wetted, or they escape by crawling up partially submerged objects such as vegetation or rocks. A characteristic of many species is the more or less simultaneous mass emergence of thousands of adults. On reaching the water surface the adults immediately take flight. The empty cases, with gill filaments still attached, remain enclosed in their cocoons after the adults have emerged and retain their taxonomic value. Consequently, they provide useful information on the species of simulids that have recently bred and successfully emerged from various habitats. A few African and Asian black fly species have a very unusual aquatic existence. For example, in East Africa larvae of S. neavei (except first instars) and pupae do not occur on submerged rocks or vegetation but on other aquatic arthropods, such as the bodies of immature stages (nymphs) of mayflies (Ephemeroptera), and various crustacean including freshwater crabs. Such an association is termed a phoretic relationship. Eggs, however, are never found on these animals; they are probably laid on submerged stones or vegetation.

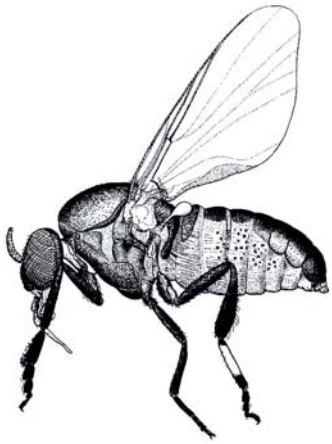


Fig.1. Adult Black fly in lateral view.

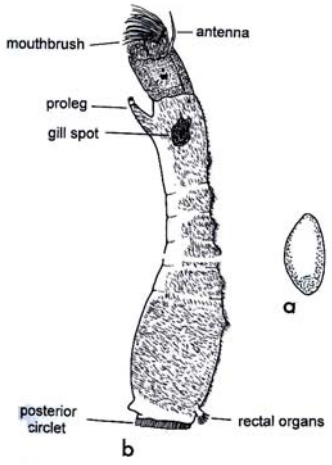


Fig.2. a) Simuliid egg; b) Lateral view of the last larval instar showing the body covered in minute dark setae and with dorsal tubercles.

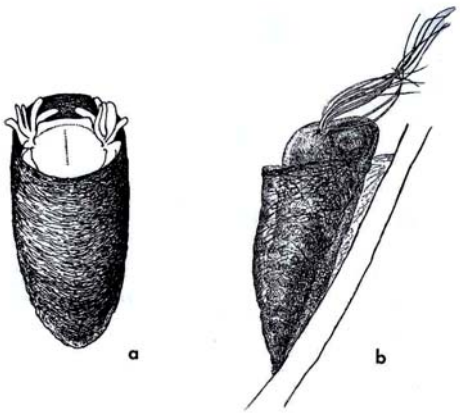


Fig.3. Simuliid pupae in cocoons. a) Dorsal view with broad and short respiratory filaments; b) Lateral view with long thin respiratory filaments.

6.3.3. **Adult behavior and disease transmission**

Both male and female black flies feed on plant juices and naturally occurring sugary substances, but only females take blood meals, which is necessary for maturation of eggs. Biting occurs out doors at almost any daylight hour, but each species may have its preferred times of biting. For example, in Africa S. damnosum has a biting peak in the morning and another in the afternoon, where as in South America S. ochraceum bites

predominantly early in the morning between 08:00-10:00 hours. Many species seem particularly active on cloudy, overcast days and in thundery weather. Species may exhibit marked preferences for feeding on different parts of the body; for example, S. damnosum feeds mainly on the legs whereas S. ochraceum prefers to bite the head and torso. When feeding on animals adults crawl down the fur of mammals or feathers of birds, to bite the host's skin, they may also enter the ears to feed.

Many species of black fly feed almost exclusively on birds (ornithophagus) and others on non-human mammalian hosts (zoophagic). However, several species also bite people. Some human biting species seem to prefer various large animals such as donkeys or cattle and bite humans only as a poor second choice, whereas others appear to find humans almost equally attractive hosts; no species bites people alone. In many species sight seems important in host location but host odours and CO_2 out put may also be important. After feeding, blood engorged females shelter and rest on vegetation, on trees and in other natural outdoor resting places until the blood meal is completely digested. In tropics this takes 2-3 days, while in non-tropical areas it may take 3-8 days or longer, the speed of digestion depending mainly on temperature. Relatively little is known about black fly longevity, but it seems that adults of most species live for 3-4 weeks.

Female black flies may fly considerable distances (15-30 km) from their breeding sites to obtain blood-meals and may also be dispersed long distances by winds. For example, adults of S. damnosum bite 60-100kn from their breeding places, and in West Africa there is evidence that prevailing winds can carry adults up to 400-600km. The long distances involved in dispersal have great relevance in control programmes, because areas freed from black flies can be reinvaded from distant breeding places.

The female black fly mates only once during her life, on the day following emergence. It then seeks a blood meal, which is necessary for the maturation of her eggs, and is ready for oviposition 4 to 5 days after the meal. If the blood meal is taken from a person infected with onchocerciasis, microfilariae may be ingested with the blood. These do not multiply in the black fly but undergo development in to infective larvae (L_3) capable of becoming

sexually mature adult worms in the human hosts. The development is completed only by the time of the third blood meal.

Many of the microfilariae ingested during feeding are destroyed or excreted, but some penetrate the stomach wall and migrate to the thoracic muscles where they develop into sausage shaped stages and undergo two molts. A few survive and elongate into thinner infective larvae, which pass through the head and down the short proboscis. Once the infective third stage larva in the proboscis penetrate the host's skin when females alight to feed, they may develop into adults producing microfilariae that may in turn be ingested by black flies thus completing the life cycle of the parasite (see the figure of life cycle in the core module). The interval between the ingestion of microfilariae to the time infective larvae are in the proboscis is between 6-13 days. The time between the entry of the larvae (L_3) and the appearance of onchocercal symptoms, the incubation period, varies from one to three years.

- For the black fly to function as a vector it must survive the laying of two batches of eggs.

6.4. Prevention and Control of onchocerciasis

There are no animal reservoirs, so the disease is not a zoonotic. Black flies are the only vectors for transmitting onchocerciasis. There are no effective vaccines or chemoprophylactic agents for the disease. The prevention and control measures are vector control, chemotherapy, and personal protection measures from biting during the day and health education about mode of disease transmission and prevention and control methods.

African Programme for Onchocerciasis Control (APOC)

From 1989 to 1994, the Nongovernmental Development Organizations (NGDO) pioneered mass distribution of ivermectin known as the Ivermectin Distribution Programme (IDP). As the result of this, the NGDO Coordination Group for Onchocerciasis Control was created in 1991 at the WHO Headquarters. However, building on the knowledge and experience

gained in OCP, the sponsoring agencies and the NGDO Group launched, in 1995, a second programme to combat the rest of Africa's river blindness named the African Programme for Onchocerciasis Control (APOC).

APOC is a bigger partnership programme than OCP including 19 Participating Countries with effective and active involvement of the Ministries of Health and their affected communities, several international and local NGDOs, the private sector (Merck & Co., Inc.), donor countries and UN agencies. The World Bank is the Fiscal Agent of the Programme and WHO is the Executing Agency of the Programme. The Community-Directed Treatment with Ivermectin (CDTI) is the delivery strategy of APOC. It empowers local communities to fight river blindness in their own villages, relieving suffering and slowing transmission. After just 8 years of operations, APOC has established 107 projects, which in 2003 treated 34 million people in 16 countries. The programme intends over the following years to treat 90 million people annually in 19 countries, protecting an at risk population of 109 million, and to prevent 43 000 cases of blindness every year.

Ethiopia is a member of the APOC, which was established in December 1995. APOC was built on the success of the onchocerciasis control program in West African countries, which now have reached to the verge of eliminating the disease. APOC is unique partnership that has brought together donors, 19 affected countries in Africa NGDOs, the private sector and affected communities. The main control approach employed by this program is control of the disease by establishing community-directed treatment with the drug ivermectin (CDTI), supplemented with vector eradication in a few isolated foci.

National Onchocerciasis Task Force (NOTF) in Ethiopia was established soon after the government signed the agreement to implement CDTI in 1997. The members of the task force include MOH, the carter center, WHO and representatives from the academia and health research institutes. Immediately after its establishment, NOTF has developed a 5-year plan of action and 3 CDTI project proposals, which were submitted, were subsequently approved by WHO/APOC for funding and technical support. The first approved proposal was the Kaffa-Sheka project that marked the launching of the Ethiopian program for onchocerciasis control (EPOC) in 2000.

Goal

The ultimate goal of APOC and thus EPOC is to eliminate onchocerciasis as a disease of public health and socio-economic development importance.

Objectives

- To establish effective and self-sustainable CDTI through out the endemic areas
- To eliminate the vector and hence the disease

Strategy

CDTI is the main strategy of APOC and EPOC.

6.4.1. Vector Control

Once the life cycle of *O. volvulus* and the role of black flies in transmitting infection had been established, it become clear that control of the disease might be feasible by attacking the vector. Vector control needs knowledge of breeding sites and certain factors such as dispersal potential and resting sites.

6.4.1.1. Larviciding

The only practical method at present available for the control of black flies is the weekly application of insecticides to their breeding places to kill the larvae. Insecticides need be applied to only a few selected sites on watercourses for some 15-30 minutes, because as the insecticide is carried downstream it kills Simuliid larvae over a long stretches of water. The flow rates of the water and its depth are used to calculate the quantity of the insecticide to be released.

The formulations of the insecticides that are used for large-scale campaigns must be highly effective against the vectors, but safe for the rest of the environment. The constituents should be biodegradable but there must be maximum “carry” downstream from the point of application. Temephos is the preferred larvicide because of its effectiveness, its range (the distance over which it remains effective), and its safety for non-target fauna. However, the appearance of insecticide resistance in 1980 of West

Africa required users to adopt a strategy of alternating insecticides with different modes of action, if possible, so as to forestall the appearance of new resistance (Table 1). Because of the need for rotation, six insecticides are now used in the OCP area, namely temephos, pyraclofos, phoxim, permethrin, carbosulfan, and Bacillus thuringiensis serotype H-14 (B. Bacillus thuringiensis serotype H-14). Temephos and pyraclofos, both organophosphorus compounds, are regarded as the most effective larvicides; they have fairly low operational doses, and a carry of as much as several tens of kilometers when water levels are high. Pyraclofos tends not to be used in rivers with discharge rates above $300m^3/s$; it is never used at rates below $15m^3/s$ because of its toxicity. Phoxim does not endanger the environment, but is less effective and has a limited range. Permethrin, has a more limited range than temephos and pyraclofos, although its operational dose is very low, so that its use is not limited by high rate of flow; however, because it is somewhat toxic to non-target fauna, it is never used at flow rates less than $70m^3/s$ and, if possible, it applied for no more than 6 weeks per year to the same stretch of water. Carbosulfan is a carbamate of carry and toxicity similar to those of permethrin, but both its price and operational dose are much higher; its use is therefore for flow rates $70m^3/s$(the toxicity threshold) and $150m^3/s$ (the cost threshold). Finally B. thuringiensis serotype H-14, a bacterial insecticide, is not particularly effective in rivers, since it has a high operational dose and a low range. For this reasons, it is never used at flow rates above $15m^3/s$, although its use is justified by its environmental safety and by the unlikelihood of resistance developing.

When the river discharge rates are in the range of 15-$70m^3/s$, only organophosphorus compounds can be used, but there is then a high risk of resistance developing. In order to fill the gap, a non- organophosphorus larvicide is highly desirable.

Prolonged and intensive use of an insecticide encourages the development of resistance. Resistance can be managed by the rotation of insecticides. This rotational strategy has been implemented and gradually improved over the years by WHO. It can be summarized as follows:

- Dry season: rivers are preferably treated with B. thuringiensis serotype H-14, or treatments are stopped, if possible.

- Start of rainy season: application of organophosphorus compounds, namely temephos, phoxim and pyraclofos, are gradually increased with emphasis on the last of these when river discharges are high. To reduce the risk of resistance, no organophosphorus compound is used for more than six successive weekly cycles.
- Peak of the rainy season: permethrin or carbosulfan (maximum of 6 weeks per year for each) is alternated with an organophosphorus compound with along carry (temephos and pyraclofos).
- End of rainy season and the onset of the dry season: the first two stages are repeated in reverse order, but with less emphasis on pyroclofos.

Table 1. Black fly larvicides currently used in the Onchocerciasis Control Programme

Insecticide name, formulation and concentration of active ingredient(g/l)[a]	Chemical group	Dosage(l) Per m^3/s river discharge	Optimal range of river discharge(m^3/s)	Carry in large rivers (km)	Margin of safety[b] (fish and crustaceans)
Bacillus thuringiensis (water-dispersable concentrate)	Biological	0.72	0-15	<3	Extremely safe in most situations
Temephos(EC200)	Organophosphate	0.15-0.30	0-450	20-30	100X
Phoxim(EC500)	Organophosphate	0.16	15-70	≤6	7X
Pyraclofos(EC500)	Organophosphate	0.12	15-300	20-30	4X
Permethrin(EC200)	Pyrethroid	0.045	≥70	≤10	2X
Cabosulfan(EC250)	Carbamate	0.12	70-150	≤11	2X

[a]EC200, for example, denotes an emulsifiable concentrate containing 200g active ingredient per liter of formulated material.

[b]Indicates the level of overdosing at which fish and shrimps may be endangered; the multiplication factors apply to the value for dosage(l) per m^3/s river discharge given in column 3.

- Spray of insecticides could be hazardous to the environment and vegetation unless applied with care
- It is also expensive requiring facilities for spray and importing of chemicals

6.4.1.2 Adulticiding

Adult populations are difficult to control because of their broad dispersal and the wide variety of their resting sites, about which little is known. Although insecticide fogging or spraying of vegetation thought to harbour resting adult flies has occasionally been undertaken, this approach results in very temporary and localized control. However, the use of this insecticide treatment can serve as a means of destroying reinvading black flies.

6.4.1.3 Biological Control

1. *!Bacillus thuringiensis serotype H-14***:** This is a spore-forming bacterium that produces a crystal of toxic protein that is stomach poison for black fly larvae. This control agent, which is specific for Diptera, has little impact on non-target fauna. It is already in operational use in WHO West Africa OCP although formulations are not yet ideal because of the high dosages required.
2. *Insect Pathogens*: Microsporidia, entomophagous fungi, and mermithids have all been found in black flies, including some vector species. These pathogens certainly act as natural agents to control the black fly density.

6.4.1.4. Environmental management

- The construction of small hillside dams, causeways, irrigation channels, etc, that bring breeding places of vectors close to human populations should be removed when they are no longer needed or are broken

- Damming a stream or river to reduce the speed of the water flow and then reduce the amount of dissolved oxygen and eventually the immature stage (larvae) will die due to lack of oxygen
- Selective bush clearance with caution to avoid exacerbating ecological problems
- This environmentally safe vector control measure. It is also less expensive and feasible in many oncho endemic Africa Countries, where resources for OCP not well established.

6.4.1.5. Integrated vector Control

The integrated vector control of onchocerciasis requires the availability of a range of methods, including both medical treatment, in the form of chemotherapy and nodulectomy, and techniques aimed at suppressing the vector. At present, vector control is based entirely on the use of chemical or biological larvicides. In integrated vector control, all appropriate technological and management techniques are used to suppress the vector populations in cost effective manner.

The development of effective macrofilaricide and microfilaricidal drugs suitable for large-scale treatment of onchocerciasis and better formulations of chemical and biological larvicides for Simulium species would allow the broad integration of control techniques and resources and the use of chemotherapy in association with vector control.

Ivermectin is an effective microfilariacidal and should be used in conjunction with vector control methods. It has also a positive effect in the general health due to its impact on other parasites such as intestinal worms, lice and scabies.

6.4.2. Medical Treatment

As a microfilaricide for the treatment of human onchocerciasis only ivermectin has proved to be both highly effective and well tolerated and it may be necessary to take the drug for at least the life span of adult worms (since it does not kill the adult worm), i.e. up to 15 years.

6.4.3. Personal protection measures

Black flies bite during daytime hours and out of doors. Personal protection measures to prevent from being bitten by the flies include:

- Proper clothing
- Insect repellents: some protection, usually lasting up to 2 hours can be gained by use of repellents such as diethyltoluamide(deet), dimethylphthalate(dimp), and butyryl-tetrahydro quinoline.
- Avoiding contact with fast flowing streams or rivers, such as bathing

6.4.4. Health education

Health education provision about mode of disease transmission and prevention and control methods to the populations living in onchocerciasis prone areas is essential.

6.5. Entomological Assessment

Entomological methods are required to carry out research and surveys in all onchocerciasis control areas and they are vital for the smooth operation of control programmes. In control programmes this type of assessment has four objectives:

a) To provide pre-control data or to determine:
   i. The identify, distribution, and abundance of vectors;
   ii. Their susceptibility to operational larvicides,
   iii. The intensity of transmission (annual transmission potential)
b) To evaluate the immediate effects of the insecticide treatment (or other approach) on the aquatic and adult stages of the vector (s)
c) To provide up-to-date information on the physical state of the rivers so that insecticide application techniques and dosages may be adapted accordingly
d) To measure the effect of control methods on annual biting rate (ABR) and annual transmission potentials (ATP)

6.5.1 Techniques employed in entomological assessment

Surveys of black fly larvae in appropriate aquatic habitats provide an immediate and direct means of checking the effectiveness of larviciding or as means of breeding site identification to apply larvicides.

The capture and dissection of adult flies can be used as a means of following the dynamics of simulium populations and vector infectivity, and hence the level of potential transmission of the parasite

a) Surveys of aquatic stages

Pupa and larvae can be collected from submerged vegetation, sticks, dead leaves, and rocks in fast flowing rivers or from artificial substrates. Special crab traps are needed to monitor the S. neavei group. Collection sites should be varied from time to time to give the greatest possible fluvial coverage. Representative samples of larvae should be preserved in carnoy's fixative for cytotaxonomic determination. Adult may be reared from pupae for morphological and biochemical studies. Larval chromosomes and the morphology of adult flies are then examined to identify the species present.

To assess the effectiveness of larviciding, larvae surveys are carried out at sites selected 24-48 hours after the insecticide has been sprayed, to establish whether the pre-imaginal stages (larvae and pupa) of the vector are present.

b) Surveys of adult black flies (vector collection)

This technique, which allows the calculation of ATP, is the most important means of determining the success of a vector control operation before human parasitological parameters have changed in onchocerciasis control program.

Biting females are still collected on human bait in the absence of an effective technique for trapping host-seeking flies. Catching points are selected in the light of the particular epidemiological situation and of their accessibility. These points should preferably be sited with in the immediate flight range of the adult female from suspected larval habitats.

These are normally sited at the riverbank or at another place where biting flies are known to accumulate and this makes it easier to evaluate the impact of larvicidal operations.

In tropical locations, catching is carried out form 07:00 to 18:00 (i.e. 11 hours a day), the vector collectors working alternate hours. In onchocerciasis control programmes this method has proved both reliable and extremely sensitive for the assessment of vector population fluctuation.

C) Identification and dissection for parity and parasites

Samples from each hour are identified and dissected so that their parity (parous or nulliparous) can be physiologically determined by the examination of the ovaries and parous flies are then examined further to detect possible infection with O. volvulus.

A high proportion of nulliparous females indicate incomplete control, probably resulting from shortcomings in larviciding or the colonization of untreated tributaries. A high proportion of parous females indicates aging of the local black fly populations, which reflects either successful larviciding or the presence of migrated female flies.

6.5.2. Transmission indices

The most important determinant of the burden of infection in a community is the infective density of the vector. The biting density of black flies can be measured by regular dawn to dusk catches using human bait at selected sites. This allows the calculation of the monthly biting rate (MBR) a theoretical estimate of the total number of bites an individual could receive if maximally exposed of that site.

$$\textbf{MBR} = \frac{\text{No. of black flies caught X No. of days in the month}}{\text{No. of catching days}}$$

The basic index for expressing the level of transmission of O. volvulus infective larvae (L_3) is the monthly transmission potential (MTP) calculated from larvae found during dissection.

MTP = MBR X Total No. of O. volvulus L_3 larvae in the head

No. Of flies dissected

The ABR is the sum of the 12 monthly biting rates for the year and ATP is the sum of the 12 monthly transmission potentials.

When calculating annual transmission potentials some workers have counted all infective stage larvae (L_3) whenever they are found in the fly; therefore, it is best to differentiate between the ATP value when only larvae in the head have been counted and the ATP when all L_3 larvae have been counted

6.5.3. Methods of detecting insecticide resistance

a) **Aquatic stages**: The larvae are placed in contact with the insecticide for 3 hours in pre oxygenated stagnant water. The mortality reading is made directly on completion of the exposure time. Discriminative dosages can be determined for the rapid detection of specimens suspected of being resistant.
b) **Adult flies**: The methods are based either on the topical application of micro drops or on placing the flies in contact with surfaces coated with insecticides. Resistance can be detected in adults at times of the year when collection of larvae is difficult. It should also be possible to test susceptibility to certain insecticides, such as the parathyroids.

- Now you are through with the core and satellite modules, but in order to evaluate your self you need to do the pre-test and post-test. Use a separate answer sheet.
- At last compare your answers of the pre and post-tests with the answer given.

UNIT SEVEN

SATTELITE MODULE FOR EXTENTION PACKAGE HEALTH WORKERS

7.1. Introduction

7.1.1. Purpose of the module:

- Extension package health workers (EPHWs) are intended to use this module for their home-based management of onchocerciasis.
- Nurses who are working at lower level health care units and those who supervise the Extension Package Health Workers are also intended to use the module, so that they can guide them properly,
- It guides the EPHWs working at lower health care unit and community level during community directed treatment with ivermetin.
- Gives basic information needed in the prevention and control of onchoceciasis
- Helps to conduct home visit for case finding and management.
- Provide reliable information on morbidity pattern of the disease

7.1.2. Directions for use the module:

- Start with doing the pre- test by using a separate sheet.
- Study the text including the task analysis.

7.1.3. Learning objective:

After reading this module the learner will be able to:

- Recognize that onchocerciasis is a disease of public health importance.
- Identify the cause and mode of transmission of onchocerciasis.
- Recognize that onchocerciasis is a preventable disease
- Participate in community-based distribution of ivermectin in the onchocerciasis control program.
- Teach the community how to prevent onchocerciasis.

- Describe the life cycle of the black fly
- Describe adult black fly behaviors that is very important in the prevention and control of black flies
- Undertake appropriate prevention and control measures to combat onchocerciasis
- Organize and mobilize the community for effective onchocerciasis prevention and control

7.1.4. Pre-Test

Write true or false for the following questions.

1 Onchocerciasis is transmitted by Aedes mosquito.
2 Onchocerciasis is a disease that cannot be prevented
3 Blindness in onchocerciasis can best be prevented by early diagnosis and treatment.
4 Community mobilization and home based management of onchocerciasis in identified endemic area is the responsibility of EPHW

Multiple choice questions

5. One of the following statements is wrong
    a) Because of the feeding and metabolic requirements of the larvae, black fly eggs are laid in well-oxygenated waters.
    b) O.volvulus can only be transmitted by black flies of the genus Simulium
    c) It is only the female black fly that bites humans
    d) Transmission of onchocerciasis usually occurs close to black fly breeding sites in fast following rivers, giving rise to the apt term 'river blindness' for this disease.
    e) None
6. The best practical method at present available for the control of blackflies is:
    a) Insecticide spraying of vegetation thought to harbour resting adult flies
    b) Environmental management
    c) Weekly application of insecticides to their breeding places to kill the larvae
    d) Personal protection measures

7. Adult populations of black flies are difficult to control because of

a) Insecticide resistance
b) Broad dispersal potential
c) The wide variety of resting places
d) All except A e) All

Short answer questions

8. Write the name of the drug that is currently used in the onchocerciasis control program.
9. List the typical characteristics of the small black fly that helps to differentiate it from other flies.

7.2. Definition

Onchocerciasis, or “river blindness” is filarial parasitic disease affecting the skin and eyes. The adult worm lives inside fibrous nodules in the subcutaneous tissue. The fertilized female worms release thousands of microfilariae that migrate through the lymphatic vessels and cause inflammatory reactions responsible for the skin and eye lesions where they die and degenerate.

7.3. Cause

Onchocerciasis is caused by macrofilarial worm Onchocerca volvulus

7.4. Mode of transmission

Onchocerciasis is transmitted by the vector female black fly of the genus simulium. The vector breeds in fast flowing rivers or streams because of the demand for highly oxygenated water during the maturation of the larvae.

Factors that favour transmission are:

- The presence of fresh flowing river.
- Presence of black fly.
- Presence of people infected with onchocerciasis.
- Working or living near rivers
- Long stay in the endemic area

The history should determine:

- People living or coming from onchocerciasis endemic areas.
- Presence of persistent itching with skin lesions.
- Periodicity of itching (When does the itching get worse? day time/evenings)
- Intensity (severity) of itching (How much the itching interferes with the persons daily activity?)
- The distribution of the skin lesions (Which parts of the body are most affected)

7.5. Signs and Symptoms

1. Skin conditions:

1.1 Early signs

- Persistent pruritis, erythema and edema of the skin.
- Popular, pustular, nodular or urticarial lesions on the back, thighs, buttocks, extensor surfaces of upper and lower limbs.
- Subcutaneous nodules on the face, back, shoulder, hip or trunk onchocercomata (containing adult worms)

1.2 Late signs

- Lichenification (hyperpigmentation, thickingof the skin with increased skin markings)
- Lizard skin (dryness, roughness and scaling of the skin)
- Leopard skin (atrophy with depigmented and hyperpigmented lesions usually pretibial area)
- Lymphedema (persistent swelling of leggs)
- Hanging groin (atrophy of the skin and redundant folds with enlarged inguinal lymphnodes)
- Atrophy of the skin (thining of the skin with loss of skin markings hanging skin folds seen around the buttocks)
- Redness and swelling of the skin resembling erysipelas rarely occur known as Erysipelas delacosta

2. Eye involvement

2.1 Early signs

- Reduced vision
- Keratitis (redness dryness of eyes)
- Iridocyclis (redness around the cornea, photophobia and pain)
- Sclerosing keratitis (pain and haziness of cornea)

2.2 Late sign- the most severe effect of the disease includes visual Impairment and blindness

7.6. Diagnosis

- The Extension Package Health Worker must observe such skin conditions according to sign and symptoms.
- If they are doubtful during home visits they should send for further investigation (laboratory investigation skin snip).
- Identify typical differences with other skin diseases having similar characteristics, e.g. scabies.

7.7. Management

Main control strategies of onchocerciasis are early diagnosis, prompt treatment and selective vector control.

- Itching which is sever during the night must be distinguished from scabies. Nurses should teach and show clear distinction between onchocerciasis and scabies.
- Any chronic dry skin condition observed during home visits should be sent for investigation.
- Proper visual test and record by using snellen chart.
- Participating in home based (community directed) treatment of ivermectin.
- Teaching to prevent accident due to poor vision. EPHWs participate in large scale or community based distribution and treatment of ivermectin once or twice per year. Initially it has to be decided that:
  - Who should distribute ivermectin

- How the drug should be distributed (for example, at central place, house-to-house & at clinic)
- When the drug is distributed

❖ They must list the contraindication and side effects during ivermectin treatment so as to refer ill person timely manner.

❖ Ivermectin is contraindicated to:

- Pregnant mothers
- Severely ill patients
- Lactating mothers for a child less than 1 week
- Height less than 90 cm or body wt less than 15 kg.

❖ Rehabilitation – when blindness occurs as a consequence of onchocerciasis, social, psychological and vocational rehabilitation. EPHWs can actively participate the blind person needs physical if they are guided properly.

❖ EPHWs provide family- centred survey and case management by providing ivermectin.

❖ EPHWs teach the community they serve to wear long sleeved clothes and about typical characteristics of black flies to prevent the bite of the black fly.

❖ Keep records properly to report periodically. There are two record books:

o Mectizan treatment record book.

o Drug reaction record book for mectizan.

- Monthly report

Prevention and control:

- The disease is diagnosed by its characteristics and confirmed by skin snip.
- The disease is preventable. Early diagnosis and start of the treatment is important. The patient must take the drug ivermectin once or twice per year for the recommended period of time.
- Failure to diagnose and start treatment timely and failure to take the drug as directed by onchocerciasis control program and failure to refer timely will result blindness.
- The disease can be prevented by the following methods:
    - ♦ Vector control

- ♦ Early diagnosis and treatment (early start of ivermectin) and continued periodically (at least once a year)
- ♦ Preventing secondary infection and early treatment when the problem arises.
- ♦ Health education of the family & the community on the importance of:
    - o Wearing long sleeved cloths
    - o Understanding the patient's problem and how to reassure the patient.

- The training should mainly focus on:
    - Drug distribution
    - Health education
    - Community mobilization
    - Record keeping
    - Reporting monthly
- Regular surveillance in endemic area
- Information education and communication
- Annual distribution of ivermectin based on a national strategy.
- Proper record keeping and monthly report.

7.8. Guidelines to refer patients with onchocerciasis to the nearest HC during home based management by EPHW.

Refer the patient

- ➢ If the nodule is on the head
- ➢ If there is sever allergic reaction following the treatment such as:

- Muscular and joint pain
- Sever itching
- Fever
- Dizziness
- Diarrhea
- Headache
- Redness of the eye
- Vomiting
- Edema

- Any individual showing skin manifestation and who does not improve with symptomatic or supportive treatment within five to ten days.
- If the village level EPHW is not sure about the skin disease.
- If there is a history of vision impairment which has occurred during adult life following chronic skin disease.

Task Analysis for Extension Package Health Workers

Learning Objective	Learning Activities
To define the nature of onchoceciasis	Study that onchocerciasis is the disease of skin and eye
To describe the cause	Identify that onchocerciasis caused by Onchocerca voluvulus
To state the modes of transmission	Recognise that onchocerciasis is transmitted by the bite of the female black fly simulium
To identify the major conditions of onchocerciasis	Study the signs and the symptoms of onchocerciasis. If possible by showing lizard skin.
To study factors initiating the occurrence of onchocerciasis.	Recognise factors that favour transmission such as: ❖ The presence of oxygenated river. ❖ Presence of black fly ❖ Working or living near the rivers that exposes for repeated bite of simulium. ❖ Long stay in the endemic area
To identify the preventive measures of Onchocerciasis	• State early diagnosis and treatment to prevent the consequences of onchocerciasis • State the need for wearing long sleeved clothes • Study the importance of health education • State the need for vector control
To believe that onchocerciasis is a public health problem	Give emphasis on health education to patients, family, school children & community.

Onchocerciasis is caused by infection with the filarial worm O. voluvulus. The microfilaria is one stage of the worm, but microfilaria does not cause onchocerciasis by itself

UNIT EIGHT

GLOSSARY

GLOSSARY

- *Biopsy*- Tissue taken for examination from living organism.
- *Collapse*- to fall down suddenly.
- *Giemsa stain*- Romanousky stain used to stain blood cells and parasites.
- *Mectizan: a synonoum of ivermectin*
- *Microfilaria*- Immature first stage of larva of filarial worm.
- *Nodule*- a small round swelling.
- *Oil emersion objective*- Microscope eye piece of 100x magnification.
- *Patch*- a pad worn over an injured body part.
- *Serological test*- A test method which bases on antigen antibody reaction.
- *Sheath*- Cover fitting closely over the larvae.
- *Skin snip* – Sharp and quick cut of skin with scissors or razor blade.
- *Topical*- external application of drug usually ointment.
- *Vertigo*- A feeling of loosing one's balance.

UNIT NINE

ABBREVIATIONS

- DNA-deoxyribonucleic acid
- ELISA- Enzyme linked immuno assy.
- PCR- polymeraze chain reaction
- WHO-World Health Organization.
- OCP: Onchocerciasis control program
- APOC- African Program for Onchocerciasis Control
- EPOC- Ethiopian Program for Onchocerciasis Control
- CDTI- Community –directed treatment with the drug ivermectin
- NGDOs- None governmental development organizations
- NOTF- National Onchocerciasis Task Force

UNIT TEN

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UNIT ELEVEN

ANNEXES

ANSWER KEY

Answer keys to pre-test for all categories

1. Onchocerca volvulus
2. Black fly of the genus Simuluim
3. 7.3 million
4. through the bite of infected black fly during a blood meal
5.
6. See the core module
7. E
8. D
9. B
10. B

Answer keys to pre-test and post-test for Health Officers

5. E 6. A 7. A 8. C

Answer keys to pre-test for professional nurses

1. Simulium, fast running oxygenated water
2. C
3. D
4. C
5. D
6. B
7. A. drug B. community mobilization C. health education
   D. record keeping and report E. sustainability of drug distribution
8. Muscular and joint pain, sever itching, fever, dizziness, diarrhea, vomiting, headache, redness of the eye, etc.

9. Pregnant woman

-Mothers in the first month of lactation

-Children under the age of five years and less than 15kg body weight

-Those severely ill

10. Woolen clothes tend to irritate dry skin.

Answer keys to pre-test for laboratory students

1. B 2.B 3.C 4.C 5.D 6.C 7. D 8.C 9.B 10.B

Answer key for Environmental Health Officers

1. E 2. C 3. D 4. E 5. E 6. F 7. D 8.E

Answer key for Extension Health Package workers

1. F 2. F 3. T 4. T 5. E 6. C 7. D

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