

MODULE

Schistosomiasis

Diploma Program
For the Ethiopian Health Center Team



Laikemariam Kassa, Anteneh Omer, Wutet Tafesse, Tadele Taye,
Fekadu Kebebew, Abdi Beker
Haramaya University

In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center,
the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education

2005



Funded under USAID Cooperative Agreement No. 663-A-00-00-0358-00.

Produced in collaboration with the Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education.

Important Guidelines for Printing and Photocopying

Limited permission is granted free of charge to print or photocopy all pages of this publication for educational, not-for-profit use by health care workers, students or faculty. All copies must retain all author credits and copyright notices included in the original document. Under no circumstances is it permissible to sell or distribute on a commercial basis, or to claim authorship of, copies of material reproduced from this publication.

©2005 by Laikemariam Kassa, Anteneh Omer, Wutet Tafesse, Tadele Taye, Fekadu Kebebew, Abdi Beker

All rights reserved. Except as expressly provided above, no part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission of the author or authors.

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

ACKNOWLEDGEMENT

The authors are grateful to The Carter Center and its staffs for the financial, material, and moral support without which it would have been impossible to develop this module.

The authors acknowledge the great assistance of Alemaya University in creating a conducive working atmosphere for the successful accomplishment of this module.

Our special thanks go to Desalegn Admasu, S/r Firehiwot Mesfin , Dr. Yimaj Abdulwahib and Fekade Ketema for their constructive comments during the initial intrainstitutional review process. The constructive comments and suggestions of Dr. Teklemariam Ayele and Fekede Balcha as external reviewer are also highly acknowledged.

We would also like to express our sincere appreciation and thank to Dr. Fikadu Zeleke for his valuable comments and unreserved help in the process of comment incorporation.

Finally, it is our pleasure to acknowledge those who have been in touch with us in the module preparation in one-way or another.

Table of Contents

Acknowledgment	i
Table of contents	ii
UNIT ONE	1
Introduction	1
Direction for using the modules	1
UNIT TWO	2
Core module	2
Significance and brief description of the problem	5
Schistosomiasis	8
UNIT THREE	21
Satellite module for public health officers.....	21
UNIT FOUR	28
Satellite module for public health nurses	26
UNIT FIVE	33
Satellite module for medical laboratory technicians	33
UNIT SIX	47
Satellite module for environmental health technicians	47
UNIT SEVEN	52
Satellite module for health extension workers	52
UNIT EIGHT	59
Take home message for care givers/self care	59
UNIT NINE	61
Role and task analysis	61
Annexes	66
References	73

UNIT ONE

INTRODUCTION

1.1 Purpose and Use of This Modules

The scarcity of relevant teaching or learning materials in the higher training institutions of Ethiopia has been one of the major problems which hinder effective and efficient task oriented problem solving training. Preparation of teaching materials that fill such a gap should be given a high priority. This module is therefore, designed to arm students of the health profession of the four disciplines all over the country with the basic knowledge, practical skill, and attitude through interactive and participatory learning.

This module will help the health center team comprised of, Public health Nurses (PHN) Medical Laboratory Technicians (MLT) and Environmental Health Technicians (EHT) to correctly identify cases of Schistosomiasis and manage them effectively as team members. Thus separate satellite modules are prepared for each professional category of the health center team based on the tasks expected from them.

The module can also be used for in-service training of the health center team and for basic training of other health professionals, health extension workers and caregivers. However, the module is not intended to replace standard textbooks or other reference materials.

1.2. Directions for Using Modules

The following steps will take you through the core module:

- Read the introduction
- Attempt to answer all pre- test questions.
- Read the core module and case study thoroughly
- Answer the post- test questions.
- Compare your answers on the pre- test to those of the post- test.

* Go through the specialized satellite modules based on the instructions given for each category.

UNIT TWO

CORE MODULE

2.1. Pretest

Choose the correct answer and write the letter of your choice on separate answer sheet

1. Which of the following are not features of intestinal schistosomiasis?
 - A. Bloody diarrhea
 - B. Ascites
 - C. Hematemesis
 - D. Hematuria
2. The most prevalent species of schistosoma in Ethiopia include
 - A. *S.mansoni*
 - B. *S.haematobium*
 - C. *S.japonicum*
 - D. A and B
3. The intermediate host for *S. haematobium* belongs to the genus
 - A. *Biomphalaria*
 - B. *Bulinus*
 - C. *Oncomalania*
 - D. All of the above
4. The infective stage of schistosoma species to human is
 - A. Egg
 - B. Miracidium
 - C. Cercaria
 - D. A and C
5. Select the wrong combination
 - A. *S.mansoni* _ Esophageal varices
 - B. *S. japonicum* _ Ascites
 - C. *S. haematobium* – Vesical calculi
 - D. *S. makongi* – Bladder cancer

6. Schistosomiasis is transmitted by
- A. Eating uncooked crayfish
 - B. Contact with urine of patients with schistosomiasis
 - C. Skin penetration by cercaria during swimming
 - D. Drinking unboiled water containing *Schistosoma* eggs
7. Which of the following symptoms may characterize acute schistosomiasis?
- A. Diarrhea
 - B. Abdominal cramps
 - C. Tenesmus
 - D. Fever
 - E. All of the above
8. A unique characteristic of *S. mansoni* eggs on microscopic examination is the presence of a
- A. Lateral spine
 - B. Terminal spine
 - C. Operculum
 - D. Rudimentary spine
9. Which of the following methods are not important for the prevention of schistosomiasis?
- A. Proper disposal of human wastes
 - B. Snail eradication
 - C. Boiling drinking water
 - D. Treating patients early with antischistosomal chemotherapy
10. The drug of choice for *S. mansoni* is
- A. Praziquantel
 - B. Metrephonate
 - C. Oxaminoquine
 - D. A and C

11. Species of schistosoma associated with bladder stone and bladder carcinoma is

- A. *S.mansoni*
- B. *S. haematobium*
- C. *S .japonicum*
- D. *S. mekongi*

12. In *S. haematobium*, eggs can be recovered in the urine after infection in about

- A. 2 weeks
- B. 12 weeks
- C. 5 months
- D. 1 year

13. The prevalence of *S.mansoni* in Ethiopia is about

- A. 5%
- B. 25%
- C. 50%
- D. 80%

14. Schistosome infection is more common in

- A. Rural
- B. Urban
- C. Displaced
- D. A and C

15. In chronic Schistosomiasis diagnosis can be made by

- A. Serum antibody tests
- B. Serum antigen tests
- C. Rectal biopsy
- D. All

2.2. Significance and Brief Description of the Problem

Schistosomiasis is one of the most widely spread parasitic infections. It occurs in most countries of tropical Africa, Middle East, Central and South America, the Caribbean and the Far East. An estimated 200 million people in the world are infected from a total of 600 million at risk. Ten percent of the infected people develop severe clinical diseases (20 million). Of the remaining 180 million people, an estimated 50-60% also has symptoms -a public health problem of enormous proportions (1). Schistosomiasis has a negative impact on economic productivity due to lost work. In Egypt 20% of the population is infected and the estimated loss exceeds US\$500million per year. In the Philippines the workdays loss due to *S. japonicum* is 40%per infected person per year. In Ghana for *S. haematobium* it is 4.4 workdays per infected person per year. The current uncontrolled agricultural and water resource development, believed to be an asset finally became a liability to many countries in Africa including Ethiopia. This has been witnessed in Awash Valley in Ethiopia. The human schstosomes are distributed through some of the countries of the world at the lower end of the economic cycle or at least the parasites are found in relatively poor rural people. Many countries of tropic and sub-tropical Africa that already have severe economic problems are further handicapped by wide spread infection among their farmers. In some part of South America, 12% of deaths in hospitals were due to the consequences of schistosomiasis. In Tanzania, 20% of persons in some areas have serious damage to their urinary system and can be expected to live only a few years. In Tanzania, Zanzibar, Nigeria and Egypt the pathological changes in children are likely to have their most serious effect in adolescence and early adulthood, just when these young people are likely to have completed schooling and are ready to become productive members of society (10, 11).

Ethiopia is one of the endemic countries for both *S.mansoni* and *S.haematobium*. Human infection caused by *S.mansoni* has a wide geographical distribution in Ethiopia. The prevalence of schistosomiasis in Ethiopia, as in other developing tropical countries, is increasing due to water related projects and population movements. The transmission of the disease is closely linked with the personal habits and livelihood requiring daily and frequent contact with contaminated water. Increasing population movements in

recent decades and deteriorating living conditions have increased the spread of schistosomiasis to areas where it was previously absent. Although the right snail hosts have been collected at higher altitudes, no parasite transmission has been known to occur. It is believed that at this altitude the low temperature will not sustain development of schistosome larvae. The disease is increasing in prevalence affecting about 10% of the world's population and ranking second to malaria as a cause of disabling disease and death. Since schistosomiasis is a clearly socio-economic problem that has its roots in rural poverty, ignorance and the persistence of certain customs and habits, it is necessary that broadly-based rural development program call for community participation be integrated into the national control program.

2.3. Learning Objectives

After going through this core module, the learners will be able to:

- Describe schistosomiasis and identify common etiologic agents
- Describe the epidemiology of schistosomiasis
- Describe the pathogenesis of common species with their life cycle.
- Discuss the clinical features of the parasite.
- Diagnose and treat patients with schistosomiasis
- Identify and manage complication of schistosomiasis
- Explain the prevention and control measures for schistosomiasis.
- List the common diagnostic methods of schistosomiasis.

2.4. Case Study-1

Abdi Oumer is an 18-year old man originally from a rural village around Awash town, currently working as a daily laborer in the Lower Awash Agro industry Plantation Farm. He visited a nearby Health Post for increasingly frequent burning sensation at the time of urination, hematuria, backache, and dull pain in the loins and suprapubic region for two months prior to presentation. He had occasional suprapubic colicky pain. He was a canal worker in the Plantation Farm for the past two years and usually bath and washes his clothes beside the canal.

At the Health Post, he was given pain relievers and advised to visit higher centers. He then visited Adama Health Center where he was seen by a health officer. The patient gave similar history at the health center and, additional information that many of the workers in the Plantation Farm experience similar problem. On physical examination the health officer found only mild tenderness over the suprapubic region and in the right flank. Microscopic urinary examination was requested and revealed ova of *S. hematobium*. The patient was sent home with four tablets of praziquantel and advised to inform the sick workers to seek medical attention and to avoid bathing at the canal. Later, a team of professionals was deployed from health center to visit the patient's village. The team was comprised of environmentalist, health officer and laboratory technicians.

After the team arrived in the village, members shared tasks among themselves. The public health officer tried to search for sick people and found many individuals with hematuria. He advised them to seek medical care at Adama Health Center. The Environmentalist observed that there is open field defecation & urination, no latrines or tap water in the village, and the villagers have the habit of regular washing after urination. On further investigation, he found snails close to the canal. The laboratory technician collected urine samples from the sick individuals and the team returned to the health center.

After returning to the health center, the team reported their findings to the health center staff and to the medical director of Adama Hospital so that a meeting will be arranged to discuss the findings. The team members agreed that the situation was serious and needed immediate solution. It was decided to deploy another team after a week for detailed investigation of conditions in the village.

Exercise

1. What are Abdi's health problems?
2. What conditions predispose Abdi to this problem?
3. What measures should be taken by the community?

2.5. Schistosomiasis

The term schistosome or schistosoma means split body and refers to the fact that the males have a ventral groove called gynocophoric canal in which the cylindrical female resides in. They are members of the Platyhelminthes and are generally flat, leaf shaped worms. Members of the family show morphological and physiological peculiarities, which distinguishes them from all other trematodes. Firstly, they are dioecious (male and female have their distinct set organs) and secondly, they live in the blood stream of warm-blooded hosts, typically in venules around the intestine or bladder depending on the species, being the only trematodes to do so. Although 18 species of the genus schistosoma are currently recognized, the majority are parasites of animals other than humans. Most infections in humans can be accounted for by *Schistosoma haematobium*, *S.japomicum* and *S.mansoni*, together with a minor contribution from *S.intercalcatum* and *S.mekongi*. Ethiopia is one of the endemic countries for both *S.mansoni* and *S.haematobium*.

2.5.1. Schistosoma mansoni

S.mansoni causes intestinal schistosomiasis.

Epidemiology

S.mansoni is widely spread in many African countries including the Sudan, Kenya, Madagascar, South America, Middle East, Brazil and India. In Ethiopia, it can occur in agricultural communities along streams in the altitudes between 1300 and 2000m above sea level *S. mansoni* is reported from all administrative regions. The major sites that harbor intermediate host snail are small streams, irrigation schemes and lakes. The infection is more common in rural than urban communities and it is more important in developing countries, because of greater dependence on agricultural products produced mostly by irrigation but also because most people are engaged in agricultural practices in rural areas. Schistosomiasis surveys carried out by the Institute of Pathobiology, Addis Ababa, in all 14 administrative regions between 1978 and 1982 found 15 % of people infected with *S. mansoni*. The national schistosomiasis survey of 1988-89 reported an overall prevalence of 25%. (1)

S. mansoni is widely distributed in Ethiopia. Out of 365 communities surveyed between 1961 and 1986 for *S. mansoni*, cases were reported from 225 (62%) and 85 (23%) and the prevalence ranged from 10 – 92% (19). Transmission occurs mainly in streams, irrigation schemes, and lakes. The intensity of infection, correlates with severity of infection, varies from locality to locality in Ethiopia. The intensity of infection of *S. mansoni* was 450, 218, and 172 EPG (geometric mean of egg out per gram of feces) in Lake Zway, Metehara irrigation scheme, and a stream in Jiga town (20, 21). The intensity of infection was moderate (100-800 EPG) using the WHO classification. (22). In some studies the prevalence and study of *S. mansoni* infection was higher in children and adolescence (21). Hence children had higher environmental contamination potential. Prevalence is higher in Moslems than Christians. Prevalence in males and in females was 42.4 % and 26.5% respectively (22). This information is relevant in selective chemotherapy in the control of schistosomiasis.

Life Cycle

S. mansoni is transmitted by cercariae penetrating the skin when a person is bathing, washing clothes, fishing, or engaged in agricultural work or other activities involving contact with water that has been fecally contaminated and contains the snail hosts of the parasite. Refer to the figure below for the mode of transmission.

The snail intermediate hosts of *S. mansoni* are *Biomphalaria pfeifferi* and *Biomphalaria sudanica*. *B. Pfeifferi* is distributed in Ethiopia. It is the most important intermediate host in the transmission of *S. mansoni*. *B. sudanica* has limited spatial distribution. It is found in Lake Zway, Awassa and Abaya. To date *B. sudanica* is the only intermediate host identified around these lakes.

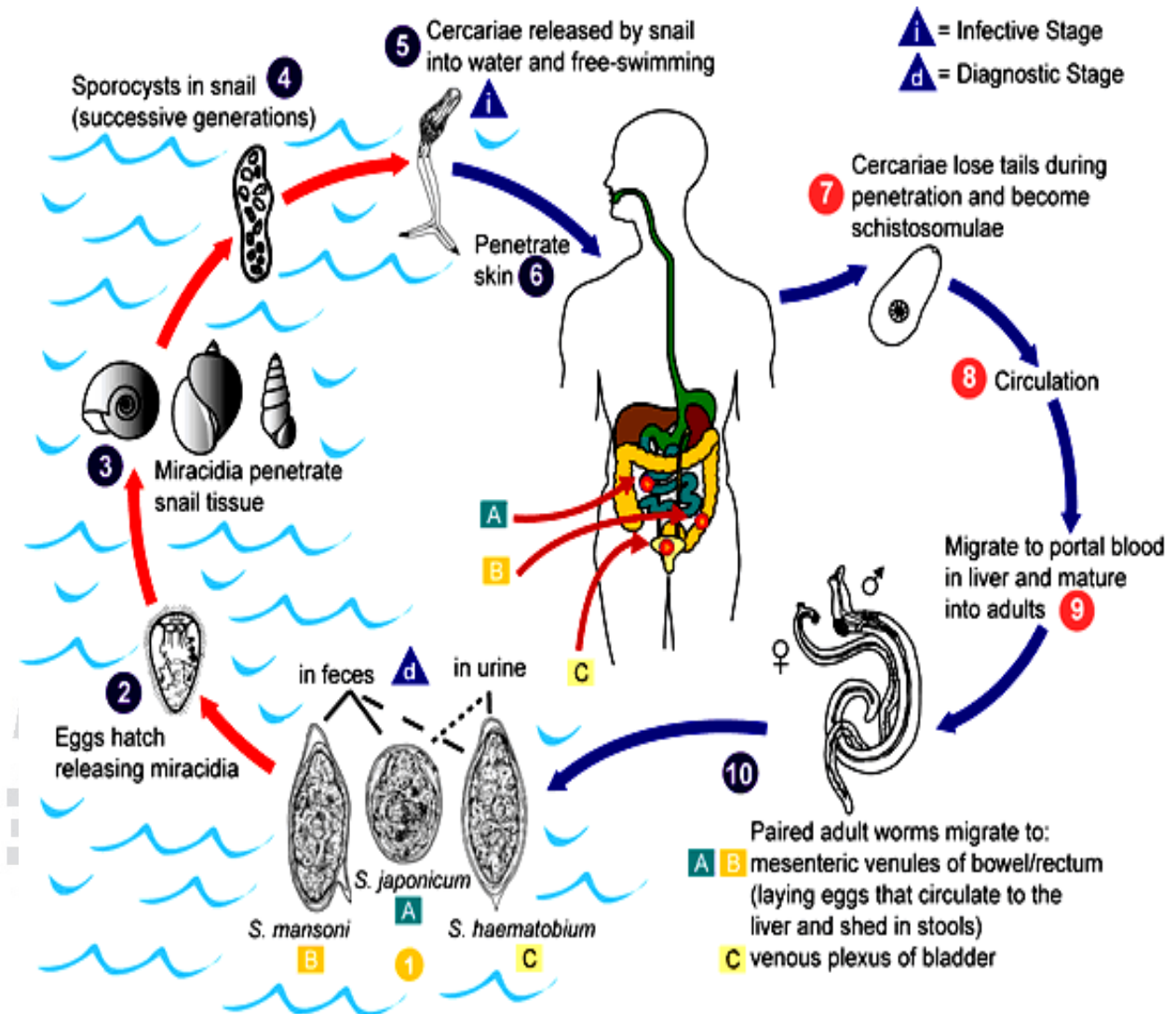


Figure-2.1. General life cycle of *Schistosoma* species

Source: DPDx Laboratory Identification of Parasites of Public Health Concern, CDC, National Center

for Infectious Diseases Division of Parasitic Diseases, USA, 2003.

Eggs are eliminated with feces or urine (1). Under optimal conditions the eggs hatch and release miracidia (2), which swim and penetrate specific snail intermediate hosts (3). The stages in the snail include 2 generations of sporocysts (4) and the production of cercariae (5). Upon release from the snail, the infective cercariae swim, penetrate the skin of the human host (6), and shed their forked tail, becoming schistosomulae (7). The schistosomulae migrate through several tissues and stages to their residence in the veins (8,9). Adult worms in humans reside in the mesenteric venules in various

locations, which at times seem to be specific for each species (10). For instance, *S. japonicum* is more frequently found in the superior mesenteric veins draining the small intestine (A), and *S. mansoni* occurs more often in the superior mesenteric veins draining the large intestine (B). However, both species can occupy either location, and they are capable of moving between sites, so it is not possible to state unequivocally that one species only occurs in one location. *S. haematobium* most often occurs in the venous plexus of bladder (C), but it can also be found in the rectal venules. The females (size 7 to 20 mm; males slightly smaller) deposit eggs in the small venules of the portal and perivesical systems. The eggs are moved progressively toward the lumen of the intestine (*S. mansoni* and *S. japonicum*) and of the bladder and ureters (*S. haematobium*), and are eliminated with feces or urine, respectively (1).

Pathogenesis

The severity and manifestation of schistosomiasis is dependent on the duration and intensity of infection, the location of egg deposition, and concurrent infection. In individuals from endemic areas, initial infection goes unnoticed. But in visitors to endemic areas, initial infection with schistosomes commonly results in acute febrile illness (Katayama fever or acute schistosomiasis), which is a manifestation of the immune response to the developing schistosomes and eggs. There may be irritation and skin rash at the site of cercarial penetration (Swimmer's itch). The cercariae develop and are transported to and develop into adult stage in the mesenteric venules. The adult flukes are protected from host immune reactions by acquiring host antigens.

The majority of *S. mansoni* eggs penetrates through the intestinal wall and are excreted in the feces sometimes with blood and mucus (estimated egg output is 100-300 eggs per day). The eggs cause damage to the liver, intestinal tract and other complications as a result of chronic inflammation caused by cellular reaction to the eggs in the tissue. Host reaction to eggs lodged in the intestinal mucosa leads to the formation of granulomata, ulceration, and thickening of the bowel wall. Large granulomata cause colonic and rectal polyps. (2, 5) Fibrosis of the ureters and bladder occur following *S. haematobium* infection.

Clinical Features

During cercarial invasion, a form of dermatitis, so called “*swimmer’s itch*” most often occurs 2 to 3 days after invasion as an itchy maculopapular rash on the affected area of the skin. Cercarial dermatitis is a self-limiting clinical entity. In the invasion stage of human schistosome cercariae dermatitis, fever, malaise, cough, and generalized allergic reactions may occur. The syndromes are induced by secretion, excretions, and breakdown products of cercariae and schistosomula. These manifestations frequently occur in tourists infected in endemic areas. In endemic communities these manifestations are rarely observed.

Acute schistosomiasis starts with worm maturation and the beginning of egg production. This stage is characterized by chill, fever, headache, dermatitis, eosinophilia, hepatosplenomegaly and generalized lymphadenopathy (known as katayama fever). The syndrome is probably due to strong host immune response to large amounts of antigenic materials which are suddenly released from schistosome worms and eggs.

In the established stage, intense egg deposition and excretion takes place. Eggs are primarily responsible for the pathological changes. Eggs of *S. mansoni* and *S. japonicum* break through the intestinal wall and cause bloody diarrhea. Similarly, the eggs of *S. hematobium* cause dysuria, urinary frequency and hematuria due to damage of the bladder wall.

In chronic stages of *S. mansoni* and *S. japonicum* portal hypertension, ascites and esophageal varices occur. In *S. hematobium* obstruction to urine flow, formation of polyps, and ulceration of the bladder wall may occur. The main clinical manifestations of chronic Intestinal Schistosomiasis include intestinal and hepatosplenic disease as well as several manifestations associated with portal hypertension. During the intestinal phase, which may begin a few months after infection and may last for years, symptomatic patients characteristically have colicky abdominal pain and bloody diarrhea, fatigue and growth retardation in children. The hepatosplenic phase of disease manifests early (during the first year of infection, particularly in children) with enlargement of liver due to parasite induced granulomatous lesion, which is seen in

about 15-20 % of, infected individuals. Moreover, portal hypertension may lead to varices at the lower end of the esophagus and at other sites and to splenomegally and ascites. Bleeding from esophageal varices may, however, be the first clinical manifestation of this phase (5).

Diagnosis

Diagnosis of infection with members of the genus *Schistosoma* is based on the following:

1. Clinical signs and symptoms.
2. History of living in an endemic area.
3. Serological tests for anti-bodies and parasite antigens.
4. Finding the characteristic eggs.

Serological tests are useful during acute phase of infection and in chronic cases in which eggs cannot be found. Serum antibody tests have a limited application because they do not differentiate between active and previous infection or re-infection. Active infection can be diagnosed by detecting circulating Schistosome antigen using a monoclonal antibody reagent.

The most common and conclusive means of diagnosing schistosomiasis is finding the characteristic eggs with lateral spine in the stool. For *S.mansoni*, fecal samples are examined by sedimentation methods designed to remove the greater portion of the fecal debris by sieving. In long standing infections, eggs may not be seen in the feces; the method then used is rectal biopsy. One or two snips of rectal mucosa are taken (the procedure is painless if properly done) and the tissue is examined microscopically while pressed between two slides. Testing viability of eggs is important in determining the stage of infection. In some long standing infections, dead eggs may be found in feces. Viability may be determined by direct examination of the eggs by inducing the eggs to hatch. (12)

2.5.2. Schistosoma haematobium /urinary Schistosomiasis/

S.haematobium causes urinary/vesical schistosomiasis. The species contain several strains.

Epidemiology

S.haematobium is endemic in 54 countries, mainly in Africa, and eastern Mediterranean. It is also found in several Indian Ocean islands and small islands of the coast of east and West Africa. In some areas the distribution of *S.haematobium* overlaps with *S.mansoni* causing double infections.

The developments of irrigation schemes and dams for hydroelectric power and flood control have greatly increased the prevalence of *S.haematobium* infections in several countries. The distribution of *S. haematobium* in Ethiopia is focal. It occurs in lowland areas at altitudes below 800 meter above sea level. *S. haematobium* is endemic in Awash Valley, Kurmuk (Western Wolega), and flood plains of Wabi Shebele (near Somali border) (23, 24, and 25). The prevalence varies from 5% to 54% in Awash Valley, assuming that infections below 5% are imported cases. In kurmuk most infections occurred in the age group 5- 24 years. In the age group 10 – 14 years, infection rate was 62.7%. The infection rate in males and females did not show statistically significant difference. Infection rate was higher in Moslems (39.9%) than Christians (18.1%).

Life Cycle

The life cycle of *S.haematobium* is similar to the life cycle of *S.mansoni* with the few exceptions. The snail intermediate hosts of *S.heamatobium* are *Bulinus Africanus* in Kurmuk and *Bulinus abyssinicus* in Awash valley (26, 27).

S.haematobium flukes pair in the blood vessels of the liver and then migrate to the veins surrounding the bladder (vesical plexus). The female lays eggs in the venules of the bladder. The estimated egg output of *S. haematobium* is 200 up to 2000 eggs per day. Many of the eggs penetrate through the mucosa into the lumen of the bladder and are passed in the urine. Eggs can be found in the urine from about 12 weeks after infection.

About 20% of the eggs remain in the wall of the bladder and become calcified. The eggs can also be found in the ureters, rectal mucosa, reproductive organs and liver.

Pathogenesis

The clinical presentation in the invasive and acute stages of *S. haematobium* infection is similar to *S.mansoni* infection. In the established stage when the eggs penetrate through the wall of the bladder, there will be bleeding which can be found in the urine (haematuria). Eggs trapped in the wall of the bladder and in surrounding tissues cause inflammatory reactions with the formation of granulomata. Many of the eggs die and become calcified eventually producing what are known as “*Sandy patches*” in the bladder. Following prolonged untreated infection and a marked cellular immune response, the ureter may become obstructed and the bladder wall thickened leading to abnormal bladder function, urinary tract infection and eventually obstructive renal disease with kidney damage. (2, 5)

Clinical Features

It is the eggs of *S.haematobium* in the tissues that stimulate host inflammatory response that damages to the bladder and ureters. Up to 80% of children infected with *S.haematobium* have dysuria, frequency of urination and haematuria. Along with the local effects of granuloma formation in the urinary bladder, obstruction of the lower end of the ureter results in hydrourether and hydronephrosis which can be seen in 25-50% of infected children. As infection progresses, bladder granuloma undergoes fibrosis which results in typical *sandy patches* visible on cystoscopy. In many endemic areas, an association between squamous cell carcinoma of the bladder and *S.haematobium* infection can be observed. (2, 5)

Diagnosis

Diagnosis of *S.haematobium* infection is based on:

- A. Clinical signs and symptoms
- B. History of living in an endemic area
- C. Serological tests
- D. Finding the characteristic eggs.

During the acute stage and in chronic cases in which eggs cannot be found, serological tests are very useful. Serological tests that are applied for diagnosis of *S.mansoni* infection can be used for diagnosis *S.haematobium* as well. The most common and conclusive means of diagnosis is microscopic finding of eggs with *terminal spine* in urine and occasionally in feces. In long standing infections eggs may not be seen in the urine; the method then used is bladder mucosal biopsy.

Testing the viability of eggs is important in determining the stages of infection. Viability may be determined by direct examination of the eggs to look for flame cell action in the miracidia, and also by inducing eggs to hatch or by examining a preparation stained with trypan blue.

(4, 12)

2.5.3. Schistosoma japonicum

S. Japonicum is widely distributed in the Mainland China, part of the Philippines and Western Indonesia. The clinical features and pathology of *S.japonicum* infection are similar to, but often more severe, than those of *S.mansoni* infection. The egg output off *S.japonicum* is higher (about 500-3500 eggs per day). Enlargement of liver and spleen is common in all age groups. *S.japonica* infects a wide range of animals including water buffaloes, dogs, cats, cattle, pigs, sheep, goats and wild rodents. Laboratory diagnosis is based on finding characteristic eggs in the feces and rectal biopsy. The eggs are ovoid in shape and have one minute lateral spine.

2.5.4. Schistosoma intercalatum

S. intercalatum is the rarest and least pathogenic schistosome that matures in man. It causes intestinal schistosomiasis. It is found in the central and western Africa. The most common clinical symptoms are dysentery and lower abdominal pain.

The daily egg out put off *S. intercalatum* is about 300. The eggs trapped in the tissues appear to cause less post immune reaction and damage than the eggs of other Schistosomes. Highest prevalence and intensity of infection occur in the age group 5-14

years. Laboratory diagnosis can be made by finding the characteristic egg with terminal spine.

2.5.5. Schistosoma mekongi

S. Mekongi is found in Lao people's Democratic Republic, Cambodia and Thailand in the Mekong River Basin. The eggs are similar to *S.japonicum*, but slightly smaller and round. Dogs are important reservoir hosts in the transmission of *S.mekongi*.

Treatment

The treatment of schistosomiasis depends on the stage of infection and clinical presentation. Topical or systemic steroids can be for cercarial dermatitis & severe acute schistosomiasis respectively. The drug of choice for schistosomiasis is praziquantel. A single oral dose of 40 mg/Kg is generally sufficient to give cure rates of between 60-90% and reduction of 90-95% in the average number of eggs excreted. Alternatives include oxaminoquine for *S.mansoni* & metrifonate for *S.haematobium*. However, metrifonate has been lately withdrawn from the market. (2)

Prevention and Control Methods

The approaches emphasized in a strategy for control of morbidity could be:

- Health education
- Diagnosis and treatment
- Promotion of a safe water supply and sanitation.

A strategy for control of transmission would also include the above activities, together with snail control, environmental modification and expanded intersectoral coordination based on the needs of the community. The following may be utilized depending on national policy, resources, and health infrastructure. Treatment should be available in health infrastructure may not reach many of those at high risk of schistosomiasis morbidity, treatment coverage can be extended through community or school based program, with or without individual diagnosis. In low prevalence areas, those infected are treated and the strategy should include methods for limiting transmission of schistosomiasis.

1. Avoiding contact with water known to contain cercariae by:
 - Providing safe water supply to the community.
 - Construct footbridges across infested rivers and streams.
 - Providing safe recreational bathing sites
2. Preventing water becoming contaminated with eggs by:
 - Health information on safe excreta disposal
 - Treating infected persons
 - Providing sanitary facilities
 - Protecting water supplies from fecal pollution by animal reservoir hosts
(for *S. japonicum*)
3. Minimizing the risk of infection from new water conservation, irrigation schemes and hydroelectric power development by:
 - Constructing settlement camps away from canal drains and irrigation canals and providing latrines and sufficient safe water for domestic use.
 - Lining canals with cement and keeping them free from silt and vegetation in which snails can breed
 - Filling in formerly used irrigation ditches with clean soil to bury snail hosts.
 - Varying the water levels in the system.
4. Destroying snail intermediate hosts, mainly by:
 - Using molluscides where this is affordable, feasible and will not harm important animal and plant life.
 - Removing vegetation from locally used water places, draining swamps and other measures to eradicate snail habitats.
 - Taking environmental measures to prevent seasonal flooding which results in an increase in snail numbers in transmission.
 - Biological means by introducing predators like fish and insects that eat snails and *Marisa cornuarietis* snail that competes with intermediate host of schistosomiasis.
5. Treating water supplies by:
 - Using a chlorine disinfectant where possible
 - Storing water for 48 hours to allow time for any cercariae to die.

- Using filter systems at water inputs to prevent cercariae from entering. (2,4).

6. Mass or selective chemotherapy

In areas with high morbidity and intensity of infection, chemotherapy can be given by health center staff in the community/ school to reduce morbidity. The prevalence and intensity of infection is high in children and selective chemotherapy can be administered in schools. Prevalence and intensity of infection, drug tolerance, and impact of treatment should be monitored subsequently. Health extension workers can play key role in community mobilization and evaluation of treatment. With the introduction of new drugs such as praziquantel and existing metrifonate mass treatment has been possible in Ethiopia (8, 9).

2.6. Learning Activity- 2

Mesfin Kebede is a 19-year-old freshman student at Alemaya University. A week after his arrival to the university he visited the university clinic with complaints of colicky abdominal pain, bloody diarrhea and generalized body weakness. He was seen at the emergency outpatient department and the nurse on duty sent him with metronidazole and co-trimoxazole. He returned back to the clinic after a week with no improvement of his illness. He gave additional history that he had fever & skin rash two months back for which he visited Zeway Health Center where he was treated for malaria with three tablets without blood examination and his fever subsided.

Family history revealed the following information. He is from Zeway town from poor family who cannot support his schooling. Therefore, he had to engage in fishing regularly after returning from school. He is the eldest in the family and he is responsible for many activities at home including washing clothes of all family members. He usually washes clothes besides the lake.

Then the patient was then examined and laboratory tests including blood, urine and stool examination were performed. White blood count was 5500/ μ l; urine analysis was non-revealing but microscopic stool examination revealed ova of *S.mansoni*.

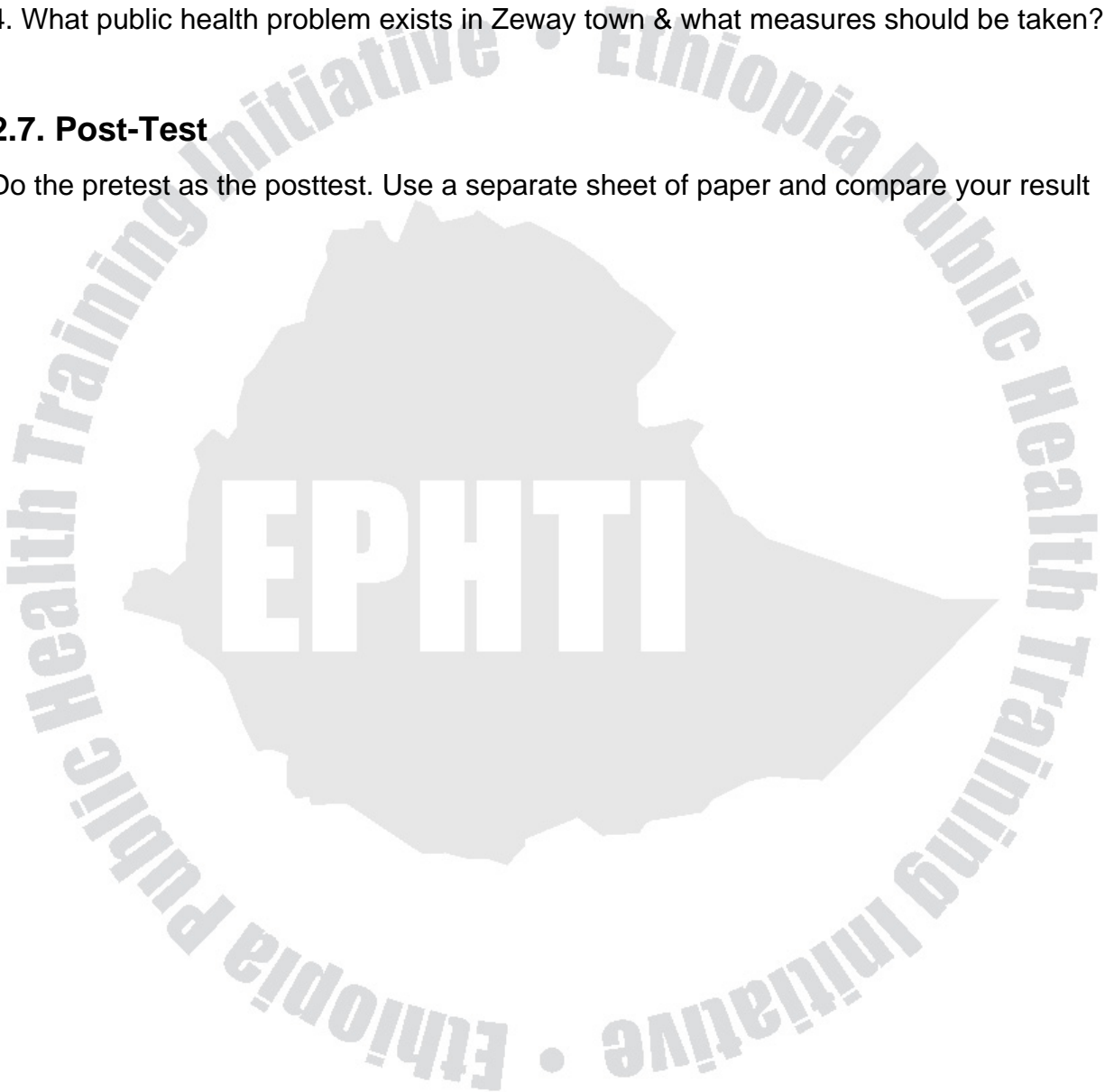
Exercise 2

Answer the following questions

1. What is Mesfin's health problem?
2. What is the predisposing factor for the illness?
3. What should have been done of the patient at the first visit to the health center?
4. What public health problem exists in Zeway town & what measures should be taken?

2.7. Post-Test

Do the pretest as the posttest. Use a separate sheet of paper and compare your result



UNIT THREE

SATELLITE MODULE FOR PUBLIC HEALTH OFFICERS

3.1. Directions for Using This Module

- ◆ Before reading the satellite module try to answer all pretest questions.
- ◆ Read the satellite module
- ◆ Refer to core module when necessary
- ◆ Do the post- test questions
- ◆ Compare the results of the pretest & posttest questions with the answers at the end of the module.

3.2. Learning Objectives

After reading this satellite module the health officer will be able to:

- ◆ Identify the etiologies of schistosomiasis
- ◆ Describe the life cycle and pathogenesis of schistosomiasis
- ◆ Describe the clinical features of intestinal and urinary schistosomiasis
- ◆ Diagnose and treated patients with schistosomiasis
- ◆ Identify common complications of schistosomiasis
- ◆ Design and implement preventive and control measures of schistosomiasis
- ◆ Create public awareness about schistosomiasis through Health information.

3.3. Pre- test Questions

1. Compare and contrast the clinical features of intestinal and urinary schistosomiasis.
2. Briefly describe the pathogenesis of schistosomiasis.
3. Discuss the life cycle of schistosoma species.
4. Describe the control & preventive methods of schistosomiasis.
5. Briefly describe the complications of intestinal & urinary schistosomiasis.

3.4. Schistosoma mansoni

Pathogenesis

During the invasive stage, cercaria-associated dermatitis reflects both humoral and cell mediated dermal and subdermal inflammatory response. As the parasite approach sexual maturity and commencement of oviposition, acute schistosomiasis or Katayama fever may occur. In chronic schistosomiasis, most disease manifestations are due to cellular and humeral inflammatory response to eggs retained in the host tissue. This result in granuloma formation around parasite eggs. The granulomatous lesions may have a big size, thus inducing organomegally and obstruction. Subsequent to granulomatous response, fibrosis sets in, resulting in more permanent disease sequelae. Accumulation of antigen antibody complexes results in deposits in renal glomeruli and may cause significant kidney disease.

Ova that are carried by portal blood to the liver lodge at the presinusoidal sites where granulomas are formed, contributing to liver enlargement. After granuloma formation, periportal fibrosis (Symmers' clay pipe stem fibrosis) may occur. Presinusoidal portal blockage causes several hemodynamic changes, including portal hypertension, ascitis and esophageal varices which may result in hematemesis. (5)

Clinical Features

In general, disease manifestations of intestinal schistosomiasis occur in three stages: swimmers' itch, Katayama fever, and chronic schistosomiasis. Swimmers' itch is a form of dermatitis which starts manifesting 2 or 3 days after invation with cercaria larvae. It appears as itchy maculopapular rash on the affected areas of the skin. It is a self-limiting clinical entity. Four to eight weeks after skin invasion acute schistosomiasis (Katayama fever) may develop. This is a serum sickness-like syndrome with fever, generalized lymphadenopathy, cough, colicky abdominal pain and diarrhea. Hepatosplenimegaly could also develop.

Chronic intestinal manifestations may manifest as colicky abdominal pain with bloody diarrhea, fatigue, and growth retardation in children. Other components of chronic intestinal schistosomiasis related to its complications are discussed below.

1. Portal hypertension

This occurs after about 10-15 years of exposure and infection. It is due to the development of periportal fibrosis. The liver may be enlarged, although in many cases it is small, firm, nodular, and the left lobe is characteristically prominent. It manifests with ascites, esophageal varices with or without bleeding, and an enlarged spleen. Patients may not have schistosome eggs in the feces because of previous treatment and/ or attrition of adult worms without subsequent reinfection. (5)

2. Fissure, Fistula in ano and piles

Fissure in ano and piles due to *Schistosoma mansoni* infection and rectal and anal egg deposit have been observed. Fistulas frequently develop into the ischioanal fossa, the perineum, the buttocks, or the urinary bladder.

3. Pulmonary hypertension

This is due to obliteration of pulmonary arterioles by granulomatous inflammation induced by embolized eggs lodged in the small arterioles. In the lungs, this may cause pulmonary hypertension and cor pulmonale. This clinical entity is an uncommon presentation in chronic schistosomiasis.

4. Glomerulonephritis

This may manifest with proteinuria and/or renal failure. (2, 5)

Diagnosis

Diagnosis of schistosomiasis is based on clinical signs and symptoms, history of living in or travel to endemic area, serologic tests & finding the characteristic eggs in stool. In chronic cases other diagnostic procedures can be used. Ultrasound of the liver can detect periportal fibrosis which is a very sensitive & specific diagnostic tool. Ultrasound can also detect the presence of ascites & splenomegaly. Ascitic fluid analysis should also be made which has transudative feature in ascites secondary to portal hypertension.

3.5. Schistosoma haematobium

Pathogenesis

Similar processes that occur in intestinal schistosomiasis occur in urinary schistosomiasis. Granuloma formation in ureters obstructs urinary flow, with subsequent development of hydroureter, hydronephrosis and retrograde urinary tract infection. Similar lesions in the urinary bladder cause the protrusions of papillomatous structures in to its cavity; these may ulcerate and/or bleed. The chronic stage of infection is associated with scarring & depositions of calcium in the bladder wall. It can also predispose to squamous cell carcinoma of the bladder. (5)

Clinical Features

Clinical manifestations of *S.haematobium* include dysuria, urinary frequency and often terminal hematuria. Local effects of granuloma formation in the bladder result in obstruction in the lower end of the ureter resulting in hydroureter and hydronephrosis. Typical sandy patches and malignant lesions can be seen by cystoscopy. Symptoms of chronic cystitis may ensue due to retrograde urinary tract infection.

Diagnosis

Diagnosis of *S.haematobium* infection is based on clinical signs and symptoms, history of living in and traveling to an endemic area, serological tests, and finding the characteristic eggs with *terminal spine* in urine. Complications can be detected by cystoscopy and ultrasound.

Treatment

Treatment of schistosomiasis depends on the stage of infection and clinical presentation.

1. Cercarial dermatitis – topical steroid for relief of itching.
2. For severe acute schistosomiasis or Katayama fever systemic glucocorticosteroid can be considered.
3. Antischistosomal chemotherapy
 - ◆ Drug of choice: Praziquantel 40-60mg/kg as a single oral dose or divided in to two or three doses is sufficient.

- ◆ Alternatives:
 - Oxaminoquine 15mg/kg single dose for *S.mansoni*
 - Metrifonet 5-15mg/kg, 3 doses given at two weeks interval for *S.haematobium*. (2, 5)
 - Artemisisinin compounds used in malaria treatment are being evaluated for schistosomiasis.

Prevention and Control

1. Health education on:

- ◆ proper excreta disposal.
- ◆ avoiding contact with infected water bodies like lakes, rivers, ponds and canals.

2. Snail control:

- ◆ Physical methods
 - Periodic clearance of canals from vegetations
 - Manual removal of snails & their destruction
- ◆ Biological methods
 - Use of natural enemies to the snails as *Marisa*
- ◆ Chemical methods
 - Molluscides are applied in the canals to kill the snails. (2)

3.4. Post-test Questions

Do the pretest as a posttest. Use separate sheet of paper.

UNIT FOUR

SATELLITE MODULE FOR PUBLIC HEALTH NURSES

4.1 Purpose and Uses of This Module

This satellite module is a reference material developed for nurse students and public health nurses in service sectors, with the aim of delivering knowledge and skills necessary and specific to the profession regarding to prevention, management and control of schistosomiasis. The module is intended to enable students and staff nurses to assess and diagnose the burden of the schistosomiasis in the community and to develop intervention measures at the individual and community level. It is also designed in such a way it can provide uniform and easy to understand information that help to solve shortage of such reference materials in remote part of working areas of our country.

4.2 Directions for Using This Satellite Module

- First complete the pretest under this section before reading core module and satellite module
- Reading learning objectives
- Read information on case management
- Then study satellite module
- Refer the core module
- Complete the post test and compare your answer of pretest and post test with the key given at the back to evaluate yourself

4.3 Pre-Test

Choose the best answer and write your choice on a separate answer sheet

1. 'Swimmer itch' of the skin is caused by
 - A. Cercarial penetration
 - B. Autoimmune reaction to the presence of egg at the site
 - C. The bite of miracidium
 - D. Contact of skin with water
 - E. All of the above.
2. The following are complication of schistosomiasis **except**
 - A. Squamous cell carcinoma of bladder
 - B. Colonic and rectal polypse
 - C. Esophageal varices
 - D. Portal hypertension
 - E. None of the above
3. The nursing care for patients with schistosomiasis include all **except**
 - A. Administering analgesics to relieve pain
 - B. Collection of urine and stool specimen
 - C. Restriction of food intake in patients with diarrhea
 - D. Administering intravenous fluid to maintain fluid volume.
 - E. None of the above
4. One of the following is **not** recommended in the prevention of schistosomiasis
 - A. How to avoid contact with water known to have cercaria
 - B. Avoid use of irrigation project to prevent infection
 - C. Protection of water source from contamination with feces.
 - D. Storing water at least for 48 hours before use to allow cercaria to die.
 - E. None of the above
5. Skin care for a patient admitted for schistosomiasis include
 - A. Inspection of skin for irritation
 - B. Frequent change of position to avoid bedsore
 - C. Dry and smooth bedding
 - D. Keeping skin clean and dry

- E. All of the above
6. Which one of the following sentence is **not** true?
- A. *S.mansoni* and *S.haematubium* are the most endemic species in Ethiopia.
 - B. Small intestine is the most common site affected by *S.haematubium*.
 - C. Both *S.mansoni* and *S.haematubium* can affect gastro –intestinal and urinary tract function.
 - D. Inflammatory reaction in schistosomiasis is caused by the presence of schistosoma egg in host tissue.
7. Conclusive diagnosis of the schistosomiasis is made by
- A. Clinical sign and symptoms
 - B. History of living in schistosoma endemic area
 - C. Serological test for antibody presence
 - D. Presence of characteristics ova in specimens
 - E. None of the above
8. Health education for a patient with schistosomiasis includes all **except**
- A. Importance of taking medication as prescribed
 - B. The effect and side effect of medications ordered
 - C. Ways of transmission and prevention of the disease
 - D. Measures should be taken to prevent complication
 - E. None of the above

4.4. Learning Objectives

4.4.1 Objective

After reading this satellite module, the learner will be able to:

- Assess patients with schistosomiasis
- Manage patients with schistosomiasis
- Explain the measures to be taken to prevent and control schistosomiasis
- Make at least four nursing diagnosis for patients with schistosomiasis
- Describe outcome criteria for nursing interventions
- Evaluate the outcome of the nursing interventions

4.5 Case Management

4.5.1 Nursing Assessment

Subjective data

Patient health history:

- To identify on set, character and duration of pain
- To identify, history of living in schistosomiasis endemic area
- Or recent travel to another geographic area where the disease is endemic
- Assess water supply, irrigation or life style that favours contact with cercaria
- Assess for human excreta disposal system.

Assess any change in bowel elimination pattern:

Stool

- Frequency
- Form (diarrhea, semisolid, solid)
- Consistency (blood, pus, mucus)
- Colour

Assess any change in urinary elimination pattern:

- Frequency of micturation urgency, pain in urination, (dysuria,) hesitancy, hematuria.

other symptoms such as;

- Fatigue, fever, itching sensation of skin, abdominal pain (Colicky, campy), bleeding from upper gastro intestinal tract, diarrhea with blood, dark stool and blood in urine.

Objective Data

Assess the general condition of the patient (acutely ill, chronically ill, emaciated.)

Assess the skin for

- Maculopapular rashes
- Cercaria dermatitis
- Conjunctiva and mucus membrane for anaemia and dehydration

Assess abdomen for

- Liver and spleen enlargement (hepatosplenomegally)

- Abdominal distension
- Ascites

Assess the general body part for;

- Generalized lymphadenopathy
- Emaciation of upper trunk and upper limbs
- Edema of lower limbs

4.5.2 Nursing Diagnosis

Based on the history and physical examination of disease condition, the major nursing diagnosis may include:

- Abdominal pain related to intestinal inflammatory process and increased peristalsis
- Diarrhoea related to intestinal inflammatory process
- Fluid and electrolyte deficit related to diarrhoea
- Alteration of nutrition, less than body requirement related to mal absorption
- Activity in tolerance related to fatigue
- High risk for skin integration related to edema, diarrhoea and mal nutrition.
- High risk for squamous cell carcinoma related to chronic irritation
- Potential for infection transmission related to contagious agents
- Knowledge deficit concerning the disease process and management

4.5.3 Nursing Goal

Major goals of patient may include

- Relief of abdominal pain and cramp
- Attainment of normal bowel and bladder elimination
- Maintenance of fluid volume and electrolyte balance
- Maintenance of optimal nutrition and weight
- Avoidance of fatigue
- Prevention of skin break down
- Absence of complications

4.5.4 Nursing Intervention

Relief of pain by

- Administering ordered analgesics or anticholinergics
- Local application of heat
- Position change

Maintaining normal elimination pattern

- Bed rest to encourage decrease peristalsis
- Administration of anti diarrhoeal medication

Maintain fluid volume

- Accurate fluid input and out put monitoring
- Daily weight monitoring
- Encouraging oral fluid intake if no contraindication
- Intravenous fluid administration with monitored rate and continuous assessment for re-hydration status.

Nutritional measures

- Total Parenteral nutrition when inflammatory process of the disease is severe
- Accurate fluid input and out put and weight monitoring
- Small, frequent, low residue diet if oral foods are tolerated.

Intermittent rest and scheduled activities to prevent fatigue

Preventing skin break down by

- Frequent inspection of skin for irritation
- Bathing and proper drying of skin
- Dry and smooth bedding if the patient is bedridden
- Frequent inspection of pressure areas

Proper collection, labelling and sending of specimen for examination.

Providing health information on:

- The disease process: causes, pathogenesis, and complication prevention
- Medication: name, dose, frequency of administration, side effect, importance of taking medication as prescribed and follow up side effect and tolerance.
- Nutritional management: bland, low residue, high protein, high calorie and vitamins diet

- Prevention of schistosomiasis including early seeking of treatment when there is suspicion of infection.
- Mobilization of community on preventive measures
- Identify risk group of community who are eligible for screening.
- Proper human excreta disposal
- Prevention of water contamination with feces and provision of safe water supply.

4.5.5 Nursing Evaluation

The following evaluation criteria can be used to measure the out come of nursing intervention

- Patient is relieved of abdominal pain
- Normal bowel and bladder elimination is attained
- Fluid volume balance is maintained
- Obtained optimal nutrition pattern, patient tolerates small frequent food with out diarrhea
- Avoid episodes of fatigue, patient rests and adheres to activities advised
- The skin integrity is maintained
- Acquires an understanding of the disease process

4.6 Post -Test

Do the posttest as the pre test and assess your progress.

UNIT FIVE

SATELLITE MODULE FOR MEDICAL LABORATORY TECHNICIANS

5.1. Directions for using this satellite module

- Read the core module thoroughly.
- Complete the pre-test for the Medical Laboratory Technicians' satellite module
- Do the post- test.

5.2. Learning Objectives

After completing this satellite module the student will be able to:

- Collect the correct specimens for the detection of *S.mansoni* and *S.haematobium*.
- Explain the principles, application, advantages and disadvantages of the different laboratory techniques for the diagnosis of intestinal and urinary schistosomiasis.
- Demonstrate the procedures of the laboratory techniques.

5.3. Pre-test

I. Choose the best answer and write the letter of your choice on a separate sheet of paper.

1. Which of the following schistosoma species has lateral spine?
 - A. *S. haematobium*
 - B. *S. japonicum*
 - C. *S. intercalatum*
 - D. *S. mansoni*
2. The following techniques are used to diagnose intestinal schistosomiasis except
 - A. Zinc sulphate floatation technique
 - B. Kato- Katz technique
 - C. Direct examination of feces

- D. Formol ether concentration technique
3. Pick out the false statement about *S.haematobium*.
- A. The eggs can be detected rarely in feces.
 - B. The urine will usually appear red-brown and cloudy.
 - C. Collecting last few drops of urine is very important for diagnosis.
 - D. By examining a single urine specimen we cannot exclude *S.haematobium* infection.
4. What is the clearing reagent used in Kato-Katz thick smear?
- A. Malachite green
 - B. Methylene blue
 - C. Trypan blue
 - D. Glycerine
5. Laboratory findings in urinary schistosomiasis does not include
- A. Glucoseuria
 - B. Haematuria
 - C. Eosinophilia
 - D. Bacteriuria
6. All are true about *Formol Ether* concentration technique except
- A. Risk of laboratory acquired infection from fecal pathogens is minimized.
 - B. The technique is rapid.
 - C. Fecal pathogens are killed by the formalin
 - D. None

II. Give short answers for the following questions.

1. What is the characteristic feature of *S. haematobium* eggs?
2. What is the material that is used as a cover slip in Kato-Katz technique?
3. What is the appropriate time to collect urine specimen for diagnosis of *S. haematobium*? Why?
4. What is the use of Ether in the Formol Ether Concentration Technique?

5.4. Techniques for laboratory diagnosis of schistosomiasis

5.4.1. Laboratory diagnosis of *Schistosoma mansoni*

General Considerations

The eggs of *S. mansoni* can be detected in feces and rarely in urine. Absence of eggs in a single fecal specimen does not necessarily imply absence of active infection; three to five tests on feces passed in different days may be needed.

The laboratory diagnosis can be done by

- Finding schistosome eggs in feces by direct examination or more commonly by using a concentration technique. The specimen will often contain blood and mucus.

Other findings

- There may be eosinophilia, raised erythrocyte sedimentation rate and low hemoglobin values (anemia)

COLLECTION OF FAECAL SPECIMEN

- A fresh fecal specimen is required.
- The specimen should not be contaminated with urine.
- A large teaspoon amount of feces is adequate or about 10 ml of a fluid specimen.
- The container should be clean, dry, leak-proof, and free from traces of antiseptics and antibiotics and have suitable size.
- Avoid using containers made from leaves, papers, or cardboard (including match boxes) because these will not be leak-proof, may not be clean, and can result in the fecal contamination of hands and surfaces.
- Specimens must be labeled correctly and accompanied by a correctly completed request form.

A. Direct Examination of Faeces

Direct examination of feces involves:

- Reporting the appearance of the specimen (macroscopic examination)
- Examining the specimen microscopically for schistosome eggs.

Reporting the appearance of faecal specimens

The following issues should be reported

- Color of the specimen.
- Consistency i.e. whether formed, semi-formed, unformed, watery
- Presence of blood, mucus, and/or pus
- Whether the specimen contains other parasitic worms, e.g. tape worm, thread worm etc.

Microscopic examination

Materials and solutions needed

- Microscope
- Microscope slide
- Cover glass
- Wire loop or wooden applicator
- Dropping bottles containing physiological saline (0.85 %w/v)

Procedure

1. Place a drop of fresh physiological saline on a slide.
 - *Don't use too large a drop of saline in order to avoid contaminating the fingers and stage of the microscope.*
2. Using a wire loop or piece of stick, mix a small amount of specimen, about 2 mg (Match stick head amount) with the saline. Make smooth thin preparations and cover it with a cover glass by holding the cover glass at an angle of 30⁰ touching the edge of the suspension and gently lowering the cover glass on to the slide so that no air bubbles are introduced.

To make sure the preparation is thin (not too thick) place the slide on a news paper. If you can see and not read the paper print, it is a good preparation.

If the specimen is dysenteric and unformed, no need of using physiological saline.

Just place a small amount of specimen including the blood and mucous using a wire loop or piece of stick. Cover with a cover glass and using a tissue, press gently on the cover glass to make a thin preparation.

3. Examine systematically the entire saline preparation for schistosome eggs. Use the 10x objective with the condenser iris closed sufficiently to give good contrast and use also the 40x objective to assist in the detection and identification of the eggs. The eggs are pale yellow-brown, large, and oval, measuring about 150x60µm. They have a characteristic lateral spine and fully developed miracidium.

4. Report the number of eggs found in the entire saline preparation as follows:

Scanty	1-3 per preparation
Few	4-10 per preparation
Moderate number	11-20 per preparation
Many	21-40 per preparation
Very many	Over 40 per preparation



Fig. 4.1 Egg of *S.mansoni* with lateral spine (Arrow)

Source: DPDx Laboratory Identification of Parasites of Public Health Concern, CDC, National Center

for Infectious Diseases Division of Parasitic Diseases, USA, 2003.

B. Concentration Techniques

When eggs are not found in direct preparations concentration methods should be performed. Even in moderate to severe symptomatic infections concentration technique may be required to detect eggs.

I. Formol ether concentration technique

This technique is rapid and risk of laboratory-acquired infection from fecal pathogens is minimized because organisms are killed by the formalin solution. The technique, however, requires the use of highly flammable ether or less flammable ethyl acetate.

Principle:

Feces are emulsified in formol water; the suspension is strained to remove large fecal particles, ether or ethyl acetate is added, and the mixed suspension is centrifuged. The eggs are fixed and sedimented and the fecal debris is separated in a layer between the ether and the formal water. Fecal fat is dissolved in the ether.

Materials and solutions needed.

- Formol water, 10%v/v
- Diethylether or ethylacetate
- Sieve (strainer) with small holes or two layers of gauze

The small inexpensive nylon tea or coffee strainer available in most countries is suitable.

- Beaker
- Microscope slide
- Cover slip
- Conical (centrifuge tube)
- Stopper
- Applicator stick
- Centrifuge
- Microscope

Procedure

1. Using a rod or stick, emulsify an estimated 1g (pea-size) of feces in about 4 ml of 10% formol water contained in a screw-cap bottle or tube.
2. Add a further 3-4 ml of 10% v/v formol water, cap the bottle, and mix well by shaking,

3. Sieve the emulsified feces, collecting the sieved suspension in a beaker.
4. Transfer the suspension to a conical (centrifuge) tube and add 3-4ml of diethyl ether or ethyl acetate.

Caution: *Ether is highly flammable and ethyl acetate is flammable, therefore use well away from an open flame. Ether vapor is anesthetic, therefore make sure the laboratory is well-ventilated.*

5. Stopper* the tube and mix for 1 minute. If using a vortex mixer, leave the tube open and mix for about 15 seconds.

**Do not use a rubber bung or a cap with a rubber liner because ether attacks rubber.*

6. With a tissue or piece of cloth wrapped around the top of the tube, loosen the stopper

(Considerable pressure will have built up inside the tube).

7. Centrifuge immediately at 3000 rpm for 1 minute.

8. Using a stick or the stem of a plastic bulb pipette, loosen the layer of fecal debris from the side of the tube and invert the tube to discard the ether, fecal debris, and formol water. The sediment will remain.

9. Return the tube to its upright position and allow the fluid from the side of the tube to drain to the bottom. Tap the bottom of the tube to resuspend and mix the sediment.

Transfer the sediment to a slide, and cover with a cover glass.

10. Examine the preparation microscopically using the 10x objective with the condenser iris closed sufficiently to give good contrast. Use the 40x objective to examine the eggs.

11. Count the number of schistosome eggs in the entire preparation. This will give the approximate number per gram of feces.

II. Kato-Katz technique

The technique is recommended by the World Health Organization (WHO) for the diagnosis of *S.mansoni*, *S.intercalatum* and *S.japonicum*.

Thousands of villages in Ethiopia have been screened for *S.mansoni* using this technique (by Institute of Pathobiology, Addis Ababa University). The technique is feasible for mass screening as the collected specimen can be examined at leisure time in the laboratory. It is a quantitative method and provides information on the intensity of infection. The technique has been used to evaluate mass chemotherapy in Jiga town (18).

For community-based surveys it is advisable to use the same technique in order to be able to compare prevalence and intensity of infection among villages/schools and select priority sites for selective chemotherapy. Until simpler techniques are developed it is advisable to use Kato-Katz technique for mass screening of *S.mansoni* in Ethiopia.

Principle:

It is based on the clearing of a thick fecal smear with glycerin in the presence of a background stain, usually malachite green. The eggs appear unstained although miracidia are not visible.

Materials and reagents needed

- Spatulas
- Filter paper or scrap paper
- Screen (stainless steel or plastic sieve)
- Template (stainless steel, plastic or cardboard)

Note: Templates of different sizes are known to exist.

A template with -9mm hole and 1mm thickness deliver 50 mg of feces

-6mm hole and 1.5mm thickness will deliver 41.7 mg of feces

-6.5mm hole and 1.5mm thickness will deliver 20 mg of feces.

- Water wettable (hydrophilic) cellophane strips, 25x30 or 25x35 mm in size.
- Microscope slide
- Flat bottom jar with lid
- Forceps
- Toilet paper or absorbent tissue

- Microscope
- Glycerol + malachite green or glycerol methylene blue solution.

[Add 1 ml of 3 % aqueous malachite green or 3% methylene blue to 100 ml glycerol and 100ml distilled water mixture. Mix well. Then pour this solution on to the cellophane strips in a jar and left for at least 24 hrs prior to use.]

Procedure

1. Mesh a portion of feces, either by pressing the sieve down on feces placed on filter paper or scrap paper, or by pushing the sample through the sieve with a spatula, to remove fiber and other coarse debris.
2. Scrap the flat-sided spatula across the upper surface of the screen to collect the sieved feces.
3. Place template in the middle of a clean microscope slide and fill with meshed feces from the spatula so that the hole is completely filled. Using the side of the spatula remove excess feces from the edge of the hole.
4. Carefully remove template and place a presoaked cellophane strip over the cylinder of feces left on the slide.
5. Invert the slide and press on an absorbent surface (e.g. toilet paper) on a bench top to spread the feces under the cellophane strip.
6. Position slide with smear uppermost to facilitate clearing of specimen and leave for 1- 24 hours.
7. Examine the smear systematically with in 24 hours and count and report the number of *S.mansoni* ova.
 - To calculate the total number of eggs per gram of feces, multiply the number of *S.mansoni* eggs in the smear by an appropriate factor. Selection of a factor depends on the template used. For example, if a 50mg template is used, the factor will be 20.

NOTE: Compare with other field technique for detecting and quantifying schistosome eggs in feces, the Kato-Katz technique is less sensitive, is unsuitable for fluid or hard specimens, can alter the morphological appearance of eggs, and the technique is less safe and hygienic. Alternative field techniques

have been suggested such as formol detergent gravity technique described below.

III. Formol detergent field technique

It is reproducible, inexpensive, simple, safe and hygienic to perform (formalin kills fecal pathogens) and gives good preservation of schistosome eggs. It is more sensitive than the Kato-Katz technique because more feces is used.

Materials and reagents required

- Universal container with a conical base and measuring spoon.
- Sieve (strainer) with small holes. The small nylon tea strainer is suitable.
- Beaker
- Plastic bulb pipette or Pasteur pipette
- Microscope slide
- Microscope
- Formol detergent solution

[To make this solution add 10 ml of detergent solution (e.g. Lipsol, Decon, Teepol or other washing up detergents) to 480 ml of clean water. Then add 10 ml of concentrated formaldehyde solution to the mixture of detergent solution and water.]

Procedure

1. Dispense about 10 ml of the formol detergent solution in to a universal container.
2. Using the spoon attached to the cap of the containers, transfer a level spoonful of feces to the container (approx.300 mg feces), and mix well in the solution to break up the feces. Tighten the cap and shake for about 30 seconds.
3. Sieve the emulsified feces, collecting the sieved suspension in a beaker. Return the sieved suspension to the conical based Universal container.
4. Stand the container upright in a rack for 1 hour (do not centrifuge)

5. Using a plastic bulb pipette or Pasteur pipette, remove and discard the supernatant fluid, taking care not to disturb the sediment (containing schistosome eggs) which has formed in the base of the containers.
6. Add about 10ml of 10% formol detergent solution and mix well for a minimum of 30 seconds. Leave the sediment for a further 1-hour. Further clearing of the fecal debris will take place.

Note: *The schistosome eggs are fixed and will not be over cleared or become distorted.*

7. Using a plastic bulb pipette remove and discard the supernatant fluid, taking care not to remove the fine sediment that has collected in the conical base of the container.
8. Transfer the entire sediment to a slide and cover with a 22x40mm cover glass or with two smaller square cover glasses.
9. Systematically examine the entire sediment microscopically for schistosome eggs using the 10x objective with the condenser iris closed sufficiently to give good contrast. Count the number of eggs and multiply the number counted by 3 to give the appropriate number per gram of feces.

5.4.2 Laboratory Diagnosis of *S.haematobium*

General considerations

The clearest demonstration of an active infection is through the detection of living eggs in urine, although occasionally, eggs may be found in faeces. The excretion of *S.haematobium* eggs in urine is highest between 10.00h and 14.00h, with a peak around midday. It is preferable to obtain such a specimen but neither exercising before passing urine nor collecting terminal urine (last few drops) increase the number of eggs present in the specimen (as once was thought). Examination of a single urine specimen is not reliable for excluding a schistosome infection, and up to four specimens, passed on different days, may be necessary because eggs may not be present in the urine all the time even when persons are heavily infected.

The laboratory diagnosis can be done by

- finding the eggs or occasionally the miracidia in urine

Other findings

- Haematuria is a common finding.
- proteinuria is frequently present.
- Eosinophils in urine and in blood
- Bacteriuria

A. Urine Sedimentation or Centrifugation Technique

It gives a qualitative and quantitative result.

Materials and equipments needed

- Urine container
- Conical test tube
- Bench centrifuge
- Cover slip
- Microscope slides
- Urine dipsticks for blood and protein detection

Procedure

1. Collect 10-15 ml of urine in a clear dry container.

Note: *If unable to examine it within 30 minutes, keep the specimen in the dark to avoid miracidia hatching from the eggs.*

2. Report the appearance of the urine.

In urinary schistosomiasis the urine will usually contain blood and appear red or red-brown and cloudy. If blood is not seen, test the specimen chemically for blood and protein using dipsticks.

3. Transfer 10 ml of well-mixed urine to a conical tube and centrifuge at RCF 500-1000g to sediment the eggs. (Don't centrifuge at greater force because this can cause the eggs to hatch)

Note: *If there is no bench centrifuge, allow the eggs to sediment by gravity for 1 hour.*

4. Discard the supernatant fluid. Transfer all the sediment to a slide, cover with a cover glass, and examine the entire sediment microscopically using the 10x objective with the condenser iris closed sufficiently to give good contrast. The eggs are pale yellow-brown, large and oval in shape, measuring about 145x55µm. They have a characteristic

small lateral spine at one end and contain a fully developed miracidium.

- Count the number of eggs in the preparation and report the number/10ml of urine. If more than 50 eggs are present, there is no need to continue counting. Report the count as "More than 50 eggs/10ml". Such counts indicate a heavy infection.



Fig.4.2. Egg of *S.haematobium* with terminal spine (Arrow)

Source: DPDx Laboratory Identification of Parasites of Public Health Concern, CDC, National Center

for Infectious Diseases Division of Parasitic Diseases, USA, 2003.

Miracidia in urine: - If the urine is dilute or has been left to stand for several hours in the light, the miracidia will hatch from the eggs. The ciliated miracidia are motile.



Fig.4.3. Ciliated miracidium of *S.haematobium* in urine.

Source: Cheesbrough M. District Laboratory Practice in Tropical Countries, Part 1, Cambridge University Press, 1998.

C. Examination of Total Volume of Urine Collected Between 10.00h and 14.00h

In light infections to increase the possibility of finding *S.haematobium* eggs, the total volume of urine excreted between 10.00h and 14.00h can be examined. The examination involves testing of the urine for protein and blood, preserving the eggs by adding 0.1ml of 10% formol saline to 50-100 ml of urine, allowing the

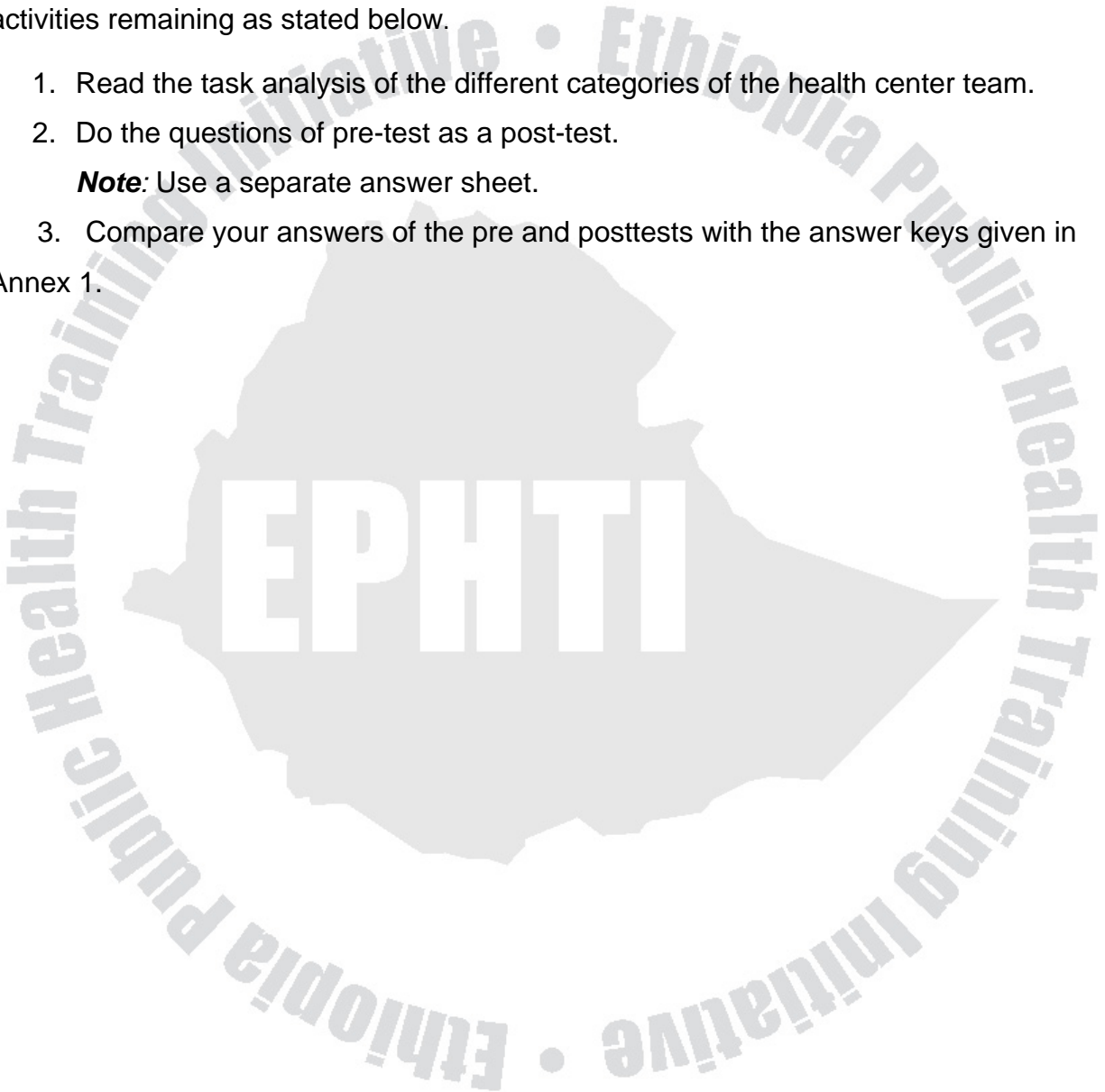
eggs to sediment (for 2 hours), discarding all but the last approximate 15 ml of urine, centrifuging the last 15ml urine and examining the sediment for *S.haematobium* eggs.

Now you are through with the core and satellite module, but there are still some activities remaining as stated below.

1. Read the task analysis of the different categories of the health center team.
2. Do the questions of pre-test as a post-test.

Note: Use a separate answer sheet.

3. Compare your answers of the pre and posttests with the answer keys given in Annex 1.



UNIT SIX

SATELLITE MODULE FOR ENVIRONMENTAL HEALTH TECHNICIANS

6.1 Introduction

6.1.1 Purpose and Brief Description of the Satellite module

The purpose of this satellite module is to equip environmental health professionals with basic knowledge and skill about the preventive and controlling measures for schistosomiasis particularly those species prevalent in Ethiopia. The module also intends to help other health professionals by providing relevant information on schistosomiasis.

Four species of the genus *Schistosoma* are important human parasites. Of these *S.mansoni*, *S.haematobium*, *S.intercalatum* and *S.japonicum* have widespread distribution. The adult male and female worms live in the blood veins and intestine of the host (human) for many years. As an adaptation for these unusual microhabitats, the worms are thread like in shape. Cylindrical and elongated females live permanently in the ventral groove (gynecophoric canal) of the shorter, stouter males. The eggs which do leave an infected person in urine or feces hatch on contact with fresh water and the emergent miracidia infect a range of aquatic and amphibious snails in which infective cercariae are produced.

6.1.2 Direction for using the satellite Module.

The learners are advised to:

- Complete the core module for a general understanding.
- Read and understand the learning objectives of this satellite module.
- Do the pre-test to evaluate your existing knowledge.
- Refer to the core module when ever necessary.

6.2 Learning Objectives

After going through the principles and concepts in this module about schistosomiasis; the learner will be able to:

- Describe the mode of transmission and life cycle of schistosomiasis.
- Identify and describe host and the environmental factors that predispose to infection.
- Apply preventive and control measures in collaboration with the community for the sustainability of the control and prevention programs.
- Evaluate the outcomes of intervention programs.

6.3 Pre Test

Choose the best answer and write the letter of your choice on a separate sheet of paper

1. How many species of schistosoma are important human parasites?
A. One B. Four C. Two D. Unknown
2. Which type of species of human schistosoma has widespread distribution in Ethiopia?
A. *S.intercalatum* B. *S.monsoni* C. *S.haematobium* D. 'B' and 'C'

Say True if the statement is correct and False if the statement is incorrect.

3. Destroying aquatic vegetation around fresh water bodies/ snail habitat is one aspect of prevention.
4. Reducing the rate of flow of water enhances the breeding of the intermediate snails.

Give short answer.

5. Explain the mode of transmission of schistosomiasis.
6. What are the factors associated with the transmission of schistosomiasis.
7. Mention the major snail control measures which in turn controls the transmission of schistosomiasis.

6.4 Schistosomiasis

6.4.1 Mode of Transmission and Life cycle

The infection is not communicable from person to person. Infection is acquired from water containing free moving cercaria that have developed in the intermediate host snails. The eggs of the *S. haematobium* leave human body mainly in the urine, those of other species in the feces. The eggs hatch in water and the larval (miracidia) penetrate into suitable fresh water snail intermediate hosts. After several weeks, the cercariae emerge from the snail intermediate host and penetrate into the human skin usually while the person is working, swimming in water, then they are carried to blood vessels of the lungs, migrate to the liver, develop to maturity and then migrate to veins of the abdominal cavity.

There are a number of reservoir hosts capable of carrying schistosoma species. Snails are intermediate hosts in which the asexual stage (larval stage) develops. Snails are more likely found in stagnant water than rapidly flowing. The snails are more likely found in stagnant than rapidly flowing water. The snail species are specific to each species of schistosoma. i.e. *Biomphalaria* for *S. mansoni* *Bulinus* for *S. haematobium* and *Onchomelania* for *S. japonicum*. *S. mansoni* and *S. haematobium* are endemic in Ethiopia. Areas with irrigation have the highest risk of infection.

The eggs of schistosomes in the excreta of an infected person hatch on contact with water and release miracidia. The miracidia soon enter the snail host. In the snail miracidia divide and produce thousands of cercaria which are released into water. The cercaria then penetrates the skin of human host, loses its tails and transforms into schistosomules. The schistosomules enter blood vessel and migrate to the lungs and reach the liver and mature to male and female adults. The female migrates to mesenteric or bladder veins and lays eggs in the gut or bladder wall. The eggs leave the body in stool or urine to repeat the life cycle once again.

6.4.2 PREVENTIVE AND CONTROL MEASURES

The most basic preventive measure to focus on is the availability and proper utilization of latrines. Elimination of open defecation and urination and the proper construction of

latrines that will not contaminate water are the primary intervention measures expected from health professionals in general and environmental health workers in particular. These strategic interventions can keep water safe for human health including making water free from intermediate hosts and reach of animal wastes. Providing adequate and safe water both for consumption and recreation reduces the contact of snails with bodies of water that carry the infectious agent (cercariae).

Providing the community with adequate health information and educating the public about the cause, the mode of transmission and prevention of infection has great importance in reducing the prevalence of schistosomiasis. Public health information is also used to promote proper excretal disposal to stop transmission and to promote the use of health services before irreversible damage and complications occur.

Making the bodies of water shallow, exposed to the sun or making the water run more quickly will make the snail's environment unfavorable. This process of environmental management for the prevention of the infections requires a multisectoral approach. This emanates from the fact that bodies of water are used for irrigation purpose, power generation, and other economic purpose that necessitate the building of dams, canals, ponds, etc. If some of these constructions are not assessed and planned with health considerations, they can enhance the breeding of snail intermediate hosts. This in turn will increase the incidence and prevalence of the infections especially in endemic areas.

Although the basic preventive and control measures are described above, the following points should be taken into consideration by environmental health professionals.

1. Avoiding contact with water known to contain cercariae by:
 - Providing safe water supply to the community.
 - Providing proper excreta and urine disposal facilities.

2. Preventing water from becoming contaminated with schistosome eggs by:
 - Giving health information based on target and high-risk group.

- Mobilizing community members to have their own sanitary waste disposal facilities.
- Identifying the infected person and giving treatment.
- Protecting water sources from fecal pollution by animal reservoir host for *S.japonicum*.

3. Minimizing the risk of infection from new water construction and irrigation schemes.

6.5 Post -Test

Do the pretest as a posttest and determine your progress.



UNIT SEVEN

SATELLITE MODULE FOR HEALTH EXTENSION WORKERS

7.1. Introduction

7.1.1. Purpose and use of this module

This satellite module on schistosomiasis is prepared for community health workers. It emphasizes on the role of community health workers in the detection and early referral of schistosomiasis cases and prevention and control of the disease. Moreover, it will help in their active participation and dissemination of information about schistosomiasis to the public. However, in order to be easily understandable this module should be translated to the local language. Meanwhile, the Community health worker should take the responsibility of conveying the message of the module.

7.1.2. Direction for using the module

- Start by attempting all the pre-test questions; write your answers on separate sheet of papers.
- Read the whole text of this satellite module in accordance with its sequence including the task analysis.
- Do the post-test on the separate sheet and compare your answer with the key provided.

7.2. Pre-test

Choose the correct answer and write your choice on a separate sheet.

1. Which of the following is the most important factor for schistosomiasis infection?
 - A. Ingesting water and food contaminated with schistosoma eggs.
 - B. Insect bite
 - C. Swimming in water containing cercariae
 - D. Ingesting fish infected with cercariae
2. What is an intermediate host for the transmission of schistosomiasis?
 - A. House fly
 - B. Mosquito
 - C. Fresh water fish
 - D. Snails
3. Which of the following is an important symptom in patients with schistosomiasis?
 - A. Itching of the skin
 - B. Bloody diarrhea
 - C. Bloody urine
 - D. Fever
 - E. All of the above
4. Which of the following is wrong about the preventive and control aspect of schistosomiasis?
 - A. Proper construction and use of latrine.
 - B. Boiling water for drinking.
 - C. Cleaning the canal where snails breed
 - D. Educating the public to avoid contact with water bodies that have cercariae and to use latrine.

7.3. Learning Objectives

After reading this satellite module, you will be able to:

- Define schistosomiasis
- List causes of schistosomiasis
- Identify probable cases of schistosomiasis
- Describe the mode of transmission of schistosomiasis
- Describe the management of schistosomiasis
- Discuss the prevention and control methods of schistosomiasis

7.4. Significance and Brief Description of the Problem

Ethiopia is one of the endemic countries for both *S.mansoni* and *S.haematobium*. The human infection caused by *S.mansoni* has a wide geographical distribution in Ethiopia. The severity of schistosomiasis in Ethiopia is increasing due to water related projects and population movements. Today, schistosomiasis causes greater morbidity and mortality than all other worm infestations. The disease is increasing in prevalence affecting about 10% of the world's population and ranking second to malaria as a cause of disability and death.

Since schistosomiasis is a socio-economic problem, the control and prevention program should be integrated with the rural development programs, particularly in small scale agricultural and water development activities.

7.5. Definition, Life Cycle, Disease Development, and Patient Presentation

Definition

Schistosomiasis is a trematode disease caused by several species of schistosomes. There are two types of schistosomiasis of public health importance in Ethiopia. Intestinal schistosomiasis caused by *S. mansoni* affects the intestine and liver while urinary schistosomiasis caused by *S. haematium* affects bladder, ureters and kidneys.

Life cycle

Human infection is by skin penetration of the cercariae stage while swimming or washing in fresh water body containing the cercariae stages. Cercariae migrate from skin to blood vessels (veins) around the intestine and bladder where they develop into adult stages. The adult worms, mate and the female worm produces eggs. The eggs penetrate into the intestinal vessels of humans and excreted in feces. The eggs develop into a stage called miracidium. The miracidium penetrates an intermediate host snail where it develops into cercariae and is released into the water. The cercariae again infect man while swimming or contact with water.

Disease development

The disease is produced as a result of damage of tissues caused by reaction of the body to schistosomula, adult worms, and mainly deposited eggs in the intestinal or bladder wall. The tissue damage is caused by host's immunological response and mechanical damage to tissues caused by eggs wherever they are deposited, i.e. intestinal or bladder wall, liver, brain, spinal cord, etc.

Patient Presentation

Patients with schistosomiasis may present with the following signs and symptoms:

- Itching of the skin at the point of cercariae penetration
- Fever and chills
- Diarrhea, abdominal cramps and tenderness
- Burning urination, bloody urine and frequent urination
- In the long run may develop abdominal swelling.

Patients are either in endemic area or travel to areas known for schistosoma and have contact with water bodies suspected to have infected snails.

7.5. Management

Early treatment is essential in patients with schistosomiasis before it damages vital body organs like the liver & kidney. Once there is damage to these organs, it is difficult to cure the patient. Therefore, community health workers should encourage patients to visit health units as early as possible.

7.6. Prevention and Control Methods

A. Proper Excreta disposal and safe water supply

When infected feces get into the bodies of water that harbor the proper snails, the life cycle of the worms can be completed and infection is transmitted. This also indicates that the life cycle of the parasite can be interrupted here, because they cannot develop without a body of water containing the proper snail host. The most basic preventive measure is to construct and use latrines. Elimination of open defecation/urination and the proper construction of latrines to prevent contamination of water is the most important preventive and control measures expected from health extension workers.

B. Information / Education /Communication

The community must be educated on the mode of transmission of schistosomiasis in order to be able to change the behavior and take a leadership role in the prevention and control of schistosomiasis. Appropriate messages must be developed for each endemic locality and the messages must be transferred to the target population. This approach aims at provision of information and to educate the public on the cause, mode of transmission and prevention of the infection. It is also used to promote proper excreta disposal to stop the transmission.

C. Eliminating or reducing breeding sites

This includes the management of bodies of water so as to minimize the breeding conditions of the snails. The snails are known to inhabit and breed in relatively stagnant and deep water. Thus, making the bodies of water shallow, exposed to the sun or making the water run faster will make the snail's environment unfavorable. The process of environmental management for the prevention of infections requires community participation. Mobilizing the community is an important issue in the prevention and control of the disease. This can be undertaken by community health workers.

7.7. Post-test questions for community health workers

Choose the correct answer and write your choice on a separate answer sheet.

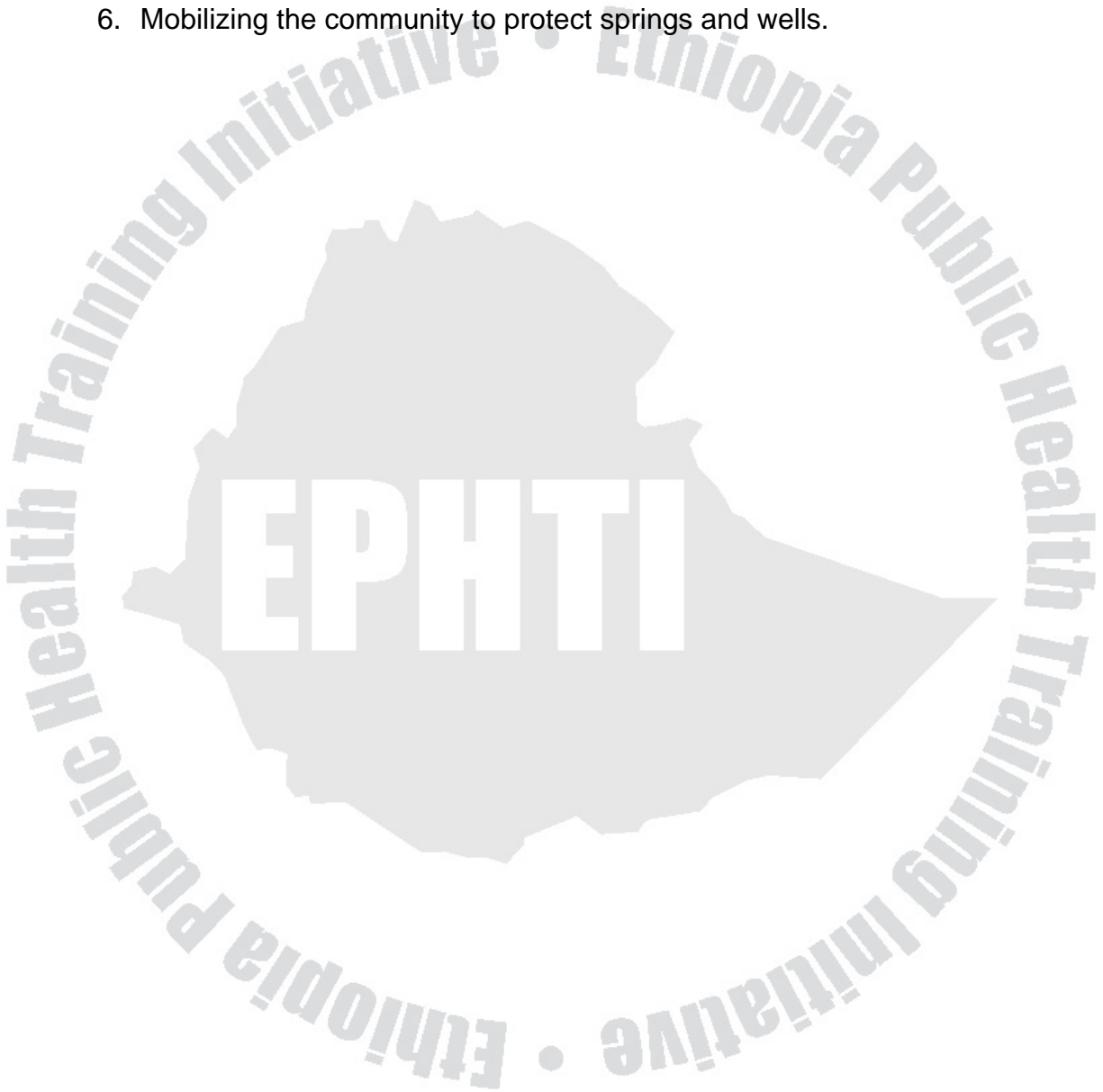
1. Which of the following is the most important factor for the infection of schistosomiasis?
 - A. Ingesting water and food contaminated with schistosome eggs.
 - B. Insect bite
 - C. Swimming in water containing cercariae
 - D. Ingesting fish infected with cercariae
2. What is an intermediate host for the transmission of schistosomiasis?
 - A. House flies
 - B. Mosquito
 - C. Fresh water fish
 - D. Snails
3. Which of the following is an important symptom in patients with schistosomiasis?
 - A. Itching of the skin
 - B. Bloody diarrhea
 - C. Bloody urine
 - D. Fever
 - F. All of the above
4. Which of the following is wrong concerning the preventive and control aspect of schistosomiasis?
 - A. Proper construction and use of latrine.
 - B. Boiling water for drinking.
 - C. Cleaning the canal where snails breed
 - D. Educating the public to avoid contact with water bodies that have cercariae and to use latrine.

Task Analysis for health extension workers

The community health worker is expected to under take the following activities:

1. Establish the presence of schistosomiasis in the community.
2. Conduct home visit to monitor drug reaction and advise defaulters.

3. Giving health information to the community about the causes, treatment and prevention methods.
4. Mobilizing the community to construct and use latrines.
5. Reporting to the nearest health institution about all activities done on this disease.
6. Mobilizing the community to protect springs and wells.



UNIT EIGHT

TAKE HOME MESSAGES FOR CARE GIVERS/SELF CARE

So far, we have discussed in detail about schistosomiasis.

Schistosomiasis is a disease caused by blood and intestinal flukes which are generally flat, leaf shaped worms in which the adult worms are adapted to live in blood vessels of intestinal wall and bladder. The male is actually flat, but its side of the body rolled ventrally forms a gynecophoric canal bearing the long flat body of the female.

Causes of Schistosomiasis

The common species of schistosoma are:

- *S. mansoni*
- *S. haematobium* and
- *S. japonicum*

Who are affected by schistosomiasis?

- People who are close to and have repeated contact with infected water bodies; closely linked with the personal habits and livelihood requiring daily and frequent contact with contaminated water such as farmers, fishermen and children and adults wading, washing, swimming and bathing.
- It affects children as well as adults

Sign and symptoms of schistosoma

- Itching sensation at the site of penetration of cercariae
- Fever
- Fatigue
- Abdominal cramping/painful urination
- Bloody diarrhea/bloody urine
- Paleness of inner eye lids, palms and finger nail beds because of blood loss

Management of schistosomiasis

Any person showing the above signs and symptoms should go to a health institution for examination and appropriate treatment.

Prevention of schistosomiasis

Infection of schistosomiasis can be prevented by:

- Construction of foot bridges across infected rivers
- Prevention of water contamination by providing health information and sanitary facilities
- Early treatment of infected persons
- Providing health information to use latrines, and sufficient and safe water supply
- Protecting water supplies from fecal pollution by animal reservoir hosts
- Minimizing the risk of infection from new water conservation, irrigation schemes and hydroelectric power development
- Destroying snail intermediate hosts by removing vegetation at water contact points and draining of swamps.
- Draining and clearing swamps.

UNIT NINE

ROLE AND TASK ANALYSIS

N.B: The scope and level of involvement in the different tasks may vary on the basis of level of training of health professionals.

9.1 Knowledge, Objectives and Learning Activities

No	Learning objectives	Learning activities			
		HO	Nurse/PHN	ENHS/EHT	MLT
1	To define schistosomiasis	Define schistosomiasis	Define schistosomiasis	Define schistosomiasis	Define schistosomiasis
2	To identify the etiology and pathogenesis of schistosomiasis	-Identify the etiologies of schistosomiasis -Study the pathogenesis of schistosomiasis	-Identify the etiologies of schistosomiasis -Study the pathogenesis of schistosomiasis	-Identify the etiologies of schistosomiasis -Study the pathogenesis of schistosomiasis	-Identify the etiologies of schistosomiasis -Study the pathogenesis of schistosomiasis
3	To describe the epidemiology of schistosomiasis	Study the prevalence of <i>S.mansoni</i> and <i>S. haematobium</i>	Study the prevalence of <i>S.mansoni</i> and <i>S. haematobium</i>	Study the prevalence of <i>S.mansoni</i> and <i>S. haematobium</i>	Study the prevalence of <i>S.mansoni</i> and <i>S. haematobium</i>
4	Explain the public health significance of schistosomiasis	Recognize the morbidity and mortality of schistosomiasis	Recognize the morbidity and mortality of schistosomiasis	Recognize the morbidity and mortality of schistosomiasis	Recognize the morbidity and mortality of schistosomiasis
5	To identify the clinical features of schistosomiasis	Describe the sign and symptoms of schistosomiasis	Describe the sign and symptoms of schistosomiasis	Learn the signs and symptoms of schistosomiasis	Learn the signs and symptoms of schistosomiasis

6	To enumerate the methods of diagnosing schistosomiasis	<ul style="list-style-type: none"> -Know the techniques of history taking and physical examination to diagnose schistosomiasis -Know the laboratory techniques used to diagnose schistosomiasis 	<ul style="list-style-type: none"> -Recognize the subjective and objective features for the diagnosis of schistosomiasis - Be familiar with the basic diagnostic methods 	<ul style="list-style-type: none"> -Recognize the different laboratory methods to detect schistosomiasis 	<ul style="list-style-type: none"> -Study the steps in diagnosing schistosomiasis -Study the different laboratory techniques to detect schistosomiasis
7	To describe the management of schistosomiasis	<ul style="list-style-type: none"> -Understand the need for early detection and treatment of schistosomiasis -Study the management of complications of schistosomiasis -Enumerate the drugs used and complications 	<ul style="list-style-type: none"> -Understand the pharmacological management of schistosomiasis -Identify the possible nursing interventions for the complications of schistosomiasis 	<ul style="list-style-type: none"> -Understand the need for early detection and treatment of schistosomiasis 	<ul style="list-style-type: none"> -Understand the need for early detection and treatment of schistosomiasis
8	To explain the preventive and control measures of schistosomiasis	<ul style="list-style-type: none"> -Study the preventive and control measures of schistosomiasis 	<ul style="list-style-type: none"> -Recognize control and preventive methods of schistosomiasis 	<ul style="list-style-type: none"> - Study the preventive and control measures of schistosomiasis -Study various environmental health actions to prevent the predisposing factors of schistosomiasis 	<ul style="list-style-type: none"> - Study the preventive and control measures of schistosomiasis

9	To recognize the interdisciplinary roles of the different health center team members in the management, prevention and control measures of schistosomiasis	-Recognize the roles of other team members.	-Recognize the roles of other team members.	-Recognize the roles of other team members.	-Recognize the roles of other team members.
---	--	---	---	---	---

9.2 Attitude, objectives and learning activities

No.	Learning objectives	Learning activities			
		HO	Nurse/PHN	ENHS/EHT	MLT
1	To recognize schistosomiasis is a significant public health problem in Ethiopia	Realize that schistosomiasis is a major health problem of Ethiopia	Realize that schistosomiasis is a major health problem of Ethiopia	Realize that schistosomiasis is a major health problem of Ethiopia	Realize that schistosomiasis is a major health problem of Ethiopia
2	To appreciate the different etiologies of schistosomiasis	Give emphasis to <i>S.mansoni</i> and <i>S.haematobium</i> species.	Give emphasis to <i>S.mansoni</i> and <i>S.haematobium</i> species.	Give emphasis to <i>S.mansoni</i> and <i>S.haematobium</i> species.	Give emphasis to <i>S.mansoni</i> and <i>S.haematobium</i> species.
3	To appreciate the life cycle of schistosomiasis	Recognize the need of intermediate host and fresh water bodies for the life cycle of schistosomiasis.	Recognize the need of intermediate host and fresh water bodies for the life cycle of schistosomiasis.	Recognize the need of intermediate host and fresh water bodies for the life cycle of schistosomiasis.	Recognize the need of intermediate host and fresh water bodies for the life cycle of schistosomiasis.

4	To recognize the signs and symptoms of schistosomiasis.	-Appreciate the need for detecting schistosomiasis early. -Focus on the important clinical features and complications.	-Focus on the important clinical features. -Give due attention to patients with schistosomiasis.	-Give emphasis to educate about the signs and symptoms of schistosomiasis,	-Recognize the signs and symptoms of schistosomiasis.
5	To give value to the diagnostic approaches of schistosomiasis	Appreciate the importance of history taking and physical examination in the diagnosis of schistosomiasis.	-Give respect and show concern to the patient during the whole diagnostic procedure.	-Believe on the need for advocacy to increase the public awareness that schistosomiasis can be easily diagnosed in health institutions.	-Recognize the different laboratory techniques and procedures to detect and interpret schistosoma species.
6	To give emphasis to appropriate management of schistosomiasis.	-Give importance to appropriate treatment of acute schistosomiasis. -Give value to appropriate management of complications of schistosomiasis.	-Give value about the curability of schistosomiasis through proper medical and nursing management.	-Realize the value for the need of appropriate management of schistosomiasis.	-Realize the value for need of appropriate management to treat schistosomiasis. - Believe that schistosomiasis can be treated.
7	To give emphasis to prevention and control measures of schistosomiasis.	-Believe on importance of health information to prevent schistosomiasis.	-Give more emphasis to health information as main preventive and control measures.	-Believe that there are specific measures to prevent and control schistosomiasis. - Give attention to health information. -Recognize the environmental control measures.	-Believe that health information is the most important measure to prevent schistosomiasis.

9.3 Practice, Objectives and Learning Activities

No	Learning Objectives	Learning Activities			
		HO	NURSE/PHN	ENHS/EHT	MLT
1	To perform appropriate diagnostic measures of schistosomiasis	Take appropriate history, perform proper physical examination.	Apply the nursing principles to diagnose the illness in the patient	Give health information on the sign and symptoms.	Conduct appropriate laboratory investigations.
2	To detect the different etiologic agents of schistosomiasis	Take appropriate history, perform proper physical examination.	Asses the patient properly for the possible causative agents.	Give health information on the root causes and the need for medical check up.	-Carry out the different laboratory investigations to identify etiologic agents/species. -Record and report the result
3	To apply proper management of schistosomiasis	-Prescribe appropriate anti-schistosomal chemotherapy. -Refer severe/complicated cases.	Carry out the appropriate nursing management and patient support principles.	Teach on personal and environmental management	- Play an active role in laboratory confirmation of a cure.
4	To conduct appropriate prevention and control measures of schistosomiasis	-Prescribe proper anti- schistosomal chemotherapy. - Give health information to individuals, family and community on the prevention and control -Ensure community involvement in the prevention of schistosomiasis.	-Give health information to individuals, family and community on the prevention and control.	Give health information on:- -the need of early detection and treatment -environmental causes and management -the need for the use of sanitary toilets -prevention of pollutions of water sources.	-Give health information to the community about prevention and control.

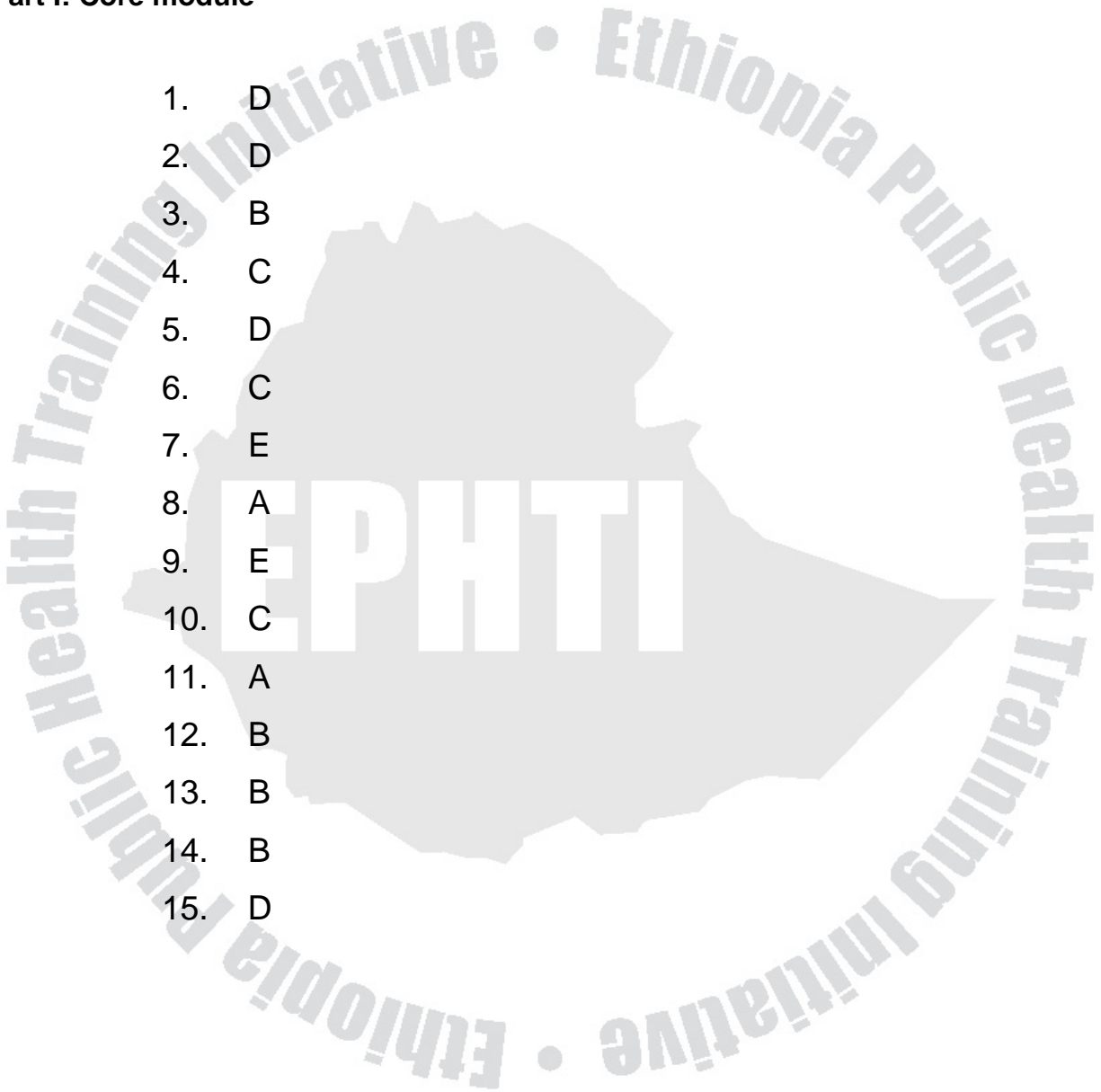
ANNEXES

Annex 1:

Answer keys to pre and posttests

Part I: Core module

1. D
2. D
3. B
4. C
5. D
6. C
7. E
8. A
9. E
10. C
11. A
12. B
13. B
14. B
15. D



Part II

A. For Health officers

1.

No.	<i>Intestinal Schistosomiasis</i>	<i>Urinary schistosomiasis</i>
1	Cercarial dermatitis, so called “ <i>swimmer’s itch</i> ” most often occurs	Cercarial dermatitis, so called “ <i>swimmer’s itch</i> ” occurs but less commonly
2	<i>Colicky</i> abdominal pain, bloody diarrhea, fatigue and growth retardation in children	Burning sensation on urination, bloody urine, and frequency of urination
3	Portal hypertension which may lead to ascites, splenomegaly, and esophageal varices	Obstruction of the lower end of the ureter which may result in hydroureter and hydronephrosis
4	Presence of periportal fibrosis on ultrasound	Presence of typical <i>sandy patches</i> visible on cystoscopy
5	No association with malignancy	An association with squamous cell carcinoma of the bladder

2.

The basis for pathogenesis of schistosomiasis is an inflammatory response both humoral and cell mediated against cercaria in early infection and more importantly to eggs deposited in several tissues. The granulomatous response around these ova is cell mediated and is regulated both negatively and positively by a cascade of cytokines, cellular and humoral response.

3.

Eggs are eliminated with feces or urine. Under optimal conditions the eggs hatch and release miracidia, which swim and penetrate specific snail intermediate hosts. Miracidia develop into cercariae in the snail. Upon release from the snail, the infective cercariae

swim; penetrate the skin of the human host which migrates through several tissues and stages to their residence in the veins. Adult worms in humans reside in the mesenteric venules in various locations; mesenteric veins for *S. mansoni* and venous plexus of bladder for *S. haematobium*. The females deposit eggs in the small venules of the portal and perivesical systems; the eggs are moved progressively toward the lumen of the intestine (*S. mansoni* and *S. japonicum*) and of the bladder and ureters (*S. haematobium*), and are eliminated with feces or urine, respectively.

4.

- ◆ Avoiding contact with water known to contain cercariae by providing safe water supply to the community for washing and bathing sites and Health information for the community
- ◆ Preventing water from contamination with eggs by providing sanitation facilities, health information and treating infected persons.
- ◆ Minimizing the risk of infection from new water conservation, irrigation schemes and hydroelectric development by treating workers when necessary and making settlements away from canal drains and irrigation canals
- ◆ Destroying snail intermediate hosts by removing vegetation from canals and using molluscides

5.

- ◆ Complications of intestinal schistosomiasis.
 1. **Portal hypertension:** is due to the development of periportal fibrosis due to granulomatous inflammation induced by embolized eggs to the liver that are lodged in the presinusoidal sites. It manifests with ascites, esophageal varices with or without bleeding, and an enlarged spleen.
 2. **Glomerulonephritis:** is due to antigen-antibody complexes deposited in the renal glomeruli. This may manifest with proteinuria and/or renal failure.

3. Fissure in ano, Fistula in ano and piles

Fissure in ano and piles due to schistosoma mansoni infection have been observed. Fistulas frequently develop into the ischiorectal fossa, the perineum, the buttocks, or the urinary bladder.

◆ **Complications of urinary schistosomiasis**

- 1. Hydroureter and hydronephrosis:** occur due to granuloma formation in the ureters obstructing urinary flow.
- 2. Bladder stone:** may form due to scarring and depositions of calcium around the eggs as nuclei in chronic stages of infection.

B. For Public Health Nursing

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

C. For Medical Laboratory Technicians

Multiple-choice items.

1. D
2. A
3. C
4. D
5. A
6. D

Short answer items.

1. *S. haematobium* eggs have terminal spine.
2. Cellophane strips soaked in glycerine/malachite green or glycerine/methylene blue solution
3. The appropriate time is between 10.00h and 14.00h because the excretion of *S. haematobium* eggs in urine is highest at this time.
4. The use of ether in Formol Ether Concentration Technique is to dissolve the fat in the feces

D. Answers for Diploma Environmental health workers

Multiple choice items

1. B
2. D

True or false

3. True
4. True

Short Answers

6. The eggs of schistosoma in an infected person open on contact with water and release miracidium. The miracidium is motile in water and tries to find fresh water snail. Once it enters the snail the miracidium divides producing thousands of new parasites called cercariae. The cercariae are then excreted by the snail in to the surrounding water. The cercariae penetrate the skin, when cercariae enter skin they loose their tails and become schistosomule. The schistosomule mature and become adult male and females. The adult females lay eggs and the eggs are excreted with feces and urine into the environment and repeat the cycle.
7. The major snail control measures are
- Biological control
 - Chemical control
 - Ecological control

Annex 2:

Abbreviations

EHT = Environmental Health Technician

MLT = Medical Laboratory Technician

PHN = Public health nurse



REFERENCES

1. Girma M. and Mohamed A. Parasitology for Medical laboratory Technology Students Lecture note Series, 2003.
2. Beaver.P.C.et al. Clinical Parasitology, 9th edition, 1984.
3. Shibru T. Introduction to Parasitology, Addis Ababa University Press, 1986.
4. Cheesbrough M. District Laboratory Practice in Tropical Countries, Part1, Cambridge University Press, 1998.
5. Brunwald E. et al. Principles of Internal Medicine, Harrison's 15th edition, 2001
6. Cox .F.E.G. Modern Parasitology, A text book of Parasitology, 2nd Blackwell Science Ltd, 1993
7. Gillespie S.H. and Hawkey P.M. Medical Parasitology, A Practical Approach, Oxford University Press, 1995
8. Abram S. Benenson. Control of Communicable Diseases Manual, American Public Health Association, 1995
9. Craig and Faust's. Clinical Parsitology, 8th edn, Lea and Febiger, 1970
10. Terefe W.,Hailu B. and Hailu Y. Schistosomiasis and intestinal helmenthic infections in Delo Awraja, Bale administrative region south Ethiopia, Ethiopian Journal of Health Development, Vol 11, Number 3, December 1997
11. Belay R., and Solomon W. Magnitude of *S.mansoni* and Intestinal helmenthic Infections among school children in Wondo-Genet Zuria, South Ethiopia, Ethiopian Journal of Health and Development, Vol 11 Number 2, August 1997
12. Marquardt W.C. et al. Parasitology and Vector Biology, 2nd edn, Harcourt Academic Press, 2000
13. Smeltzer S.C. & Bare B.G, Brunner and Suddarth's Textbook of Medical-Surgical Nursing, 8th edition, Lippincott, 1996.
14. Zein A. The Ecology of Health and Disease in Ethiopia, Ministry of Health, Addis Ababa, 1988.
15. DPDx Laboratory Identification of Parasites of Public Health Concern, CDC, National Center for Infectious Diseases Division of Parasitic Diseases, USA, 2003.
16. Mosby's Medical Encyclopedia Version 2.1 for Windows 3.1/Windows 95.
17. Microsoft Encarta Encyclopedia Standard 2002.

18. Hailu Yeneneh, et al, 1996. Praziquantel in the treatment of *Schistosoma mansoni* infection in Jiga town, northwestern Ethiopia
19. The control of schistosomiasis. Report of WHO Expert Committee. Geneva, WHO, 1985
20. Chitsulo L., et al. The global status of schistosomiasis and its control. Acta tropica, 2000, 77, (1): 41-51
21. Kloos H. et al. Schistosomiasis in Ethiopia, 1988
22. Ayele T. et al, The Epidemiology of *Schistosoma mansoni* around Lake Ziway and its islands, Ethiopia, 1987.
23. Birre H. et al, transmission of *Schistosoma mansoni* in three ecological settings in Ethiopia,(Epidemiological aspects).
24. Lo, C.T. et al, Helminth and snail survey in Hararge region of Ethiopia with special reference to Schistosomiasis , 1989.
25. Ali A. et al, *Schistosoma haematobium* in Western Ethiopia, 1986. Ethiop. Med. J. Vol. 24, pp73.
26. Birrie H. et al, evaluation of combined measures for control of intestinal schistosomiasis in an endemic community in Ethiopia, 1996. Rivista di parasitologia, vol. XIII (LVII)-N.1
27. Haile-Meskel F. et al, Endemicity of urinary schistosomiasis in Enta-Doyta village, Gewane flood plain, Eastern Ethiopia, 1985. Ethiop. Med.J. Vol. 23, pp107.

GLOSSARY

Ascites, an abnormal pooling of fluid in the abdominal cavity; the fluid contains large amounts of protein and other cells. Ascites is usually noticed when more than 1 pint (500 ml) of fluid has collected.

Bacteriuria, the presence of bacteria in the urine. More than 100,000 bacteria per ml of urine usually mean urinary tract infection is present.

Biopsy, 1. **Removing** a small piece of living tissue from an organ or other part of the body for microscopic examination to establish a diagnosis or follow the course of a disease.

2. The **tissue** removed for examination.

3. (*Informal*) to remove tissue for examination. Kinds of biopsy include aspiration biopsy, needle biopsy, punch biopsy, surface biopsy.

Cercaria, *pl. cercariae*, a tiny, wormlike form of the class Trematoda. It develops in a freshwater snail. It is released into the water and swims toward the sun, rising to the surface of the water in the warmest part of the day.

Cystoscopy, the direct examination of the urinary tract with a special device (cystoscope) placed in the urethra. Before the test, the patient either is given a tranquilizer or is put to sleep. For the test, the bladder is filled with air or water and the cystoscope is put into place. In addition to testing, cystoscopy is used for taking samples of tumors or other growths and for removing growths (polyps).

Dermatitis, an inflammation of the skin marked by redness, pain, or itching. The condition may be long-term or sudden.

Dysuria, painful urination, usually the result of a bacterial infection or blockage in the urinary tract. Dysuria is a symptom of such conditions as inflammation of the urinary bladder (cystitis), swelling of the urethra (urethritis), swelling of the prostate (prostatitis), urinary tract tumors, and some gynecological disorders.

Esophageal varices, a network of twisted veins at the lower end of the esophagus, which is enlarged and swollen as the result of high blood pressure within the

portal vein in the abdomen. These vessels often form open sores and bleed. This is often a complication of cirrhosis of the liver.

Fissure, 1. A cracklike break in the skin, as an anal fissure.

2. A split or a groove on the surface of an organ. It often marks the division of the organ into parts, as the lobes of the lung. A fissure is usually deeper than a sulcus, but *fissure* and *sulcus* are often used as if they were the same thing.

Fistula, an abnormal passage from an internal organ to the body surface or between two internal organs. Fistulas may occur in many sites from the mouth to the anus and may be made for treatment follow the course of a disease.

Fossa, pl. fossae, a hollow or pouch, especially on the surface of the end of a bone

Hematemesis, vomiting of bright red blood, indicating rapid bleeding of the upper digestive tract. It is often linked to enlarged veins in the esophagus or peptic ulcer.

Hematuria, abnormal presence of blood in the urine. Many kidney diseases and disorders of the genital and urinary systems can cause hematuria.

Hydronephrosis, swelling of the pelvis by urine that cannot flow past a blockage in a ureter.

Ureteral obstruction may be caused by a tumor, a stone lodged in the ureter, inflammation of the prostate gland, or a urinary-tract infection. The person may have pain in the flank. Surgery to remove the blockage may be needed.

Prolonged

hydronephrosis will result in eventual loss of kidney function.

Hydroureter swelling of the ureter by urine that cannot flow past a blockage in the lower ureter, bladder or urethra.

Miracidium, the larval stages of aquatic invertebrates (**e.g. Flukes**) that lead sedentary, or attached, lives in the adult stage are typically motile and free-swimming. Such larvae are found in sponges, sessile mollusks, and many rotifers and worms. These larvae serve to increase the distribution of the adults.

Proteinuria, also called **albuminuria**, having large amounts of protein in the urine, as albumin.

Proteinuria is often a sign of kidney disease or kidney problems brought on by another disease. However, proteinuria can also be caused by heavy exercise or fever.

Pyuria, white blood cells in the urine. It is a sign of infection of the urinary tract. Pyuria occurs in inflammation of the bladder, kidney, or urethra, and tuberculosis of the kidney. Pyuria may be caused by an infection from viruses. Miliary pyuria causes blood, pus, and tissue cells, as well as bacteria, in the urine.

