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EPIDEMIOLOGY OF HELMINTHIC INFECTIONS

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INTRODUCTION

- Helminthes are multicellular, bilaterally symmetrical metazoa, elongated, flat or round in shape.
- Helminthes of medical importance belong to two phyla Platyhelminthes and nematodes.
- Soil transmitted helminthic infections refer to a group of parasitic diseases in humans caused by intestinal round worms (ascariasis), hookworms (*Necator americanus* and *Ancylostoma duodenale*), and whipworm (*Trichuris trichura*).
- Widely spread in tropical and subtropical areas like Sub Saharan Africa, America, China and East Asia.
- More than 1.5 billion or about 24% of world population are affected.

Mode of Transmission

- STH are transmitted by eggs present in faeces of infected people and live as adult worms in intestines .
- The eggs contaminate the soil through several ways like-
 - 1) Eggs stick to vegetables and salad and are ingested when the vegetables are not properly cooked , peeled or washed .
 - 2) From contaminated water sources.
 - 3) Ingested by children through soiled hands.
- Also some eggs produce larva that can penetrate unbroken skin and infect people.
- No direct person to person transmission or from fresh faeces.
- Reinfection only on contact with infective stages in environment.

ASCARIASIS

- Intestinal tract infection caused by the adult *Ascaris lumbricoides*.
- **Geographic distribution and prevalence –**
 - Cosmopolitan in distribution.
 - Most common helminthic infestation .
 - About one billion people are infected world wide annually with about 12 million acute cases and 20,000 or more deaths.
 - Heavy infection is common in children aged 3 to 8 years

Epidemiological features

- **Agent and life cycle-** *Ascaris lumbricoides* lives in small intestine of humans.
 - Egg production is very heavy, about 2,40,000 eggs per day.
 - These become embryonated in external environment and infective in 2- 3 weeks.
 - On ingestion they hatch in small intestine and move to liver and then lungs via blood. In lungs they moult twice, break alveoli and reach bronchioles where they are coughed up and swallowed.
 - On reaching intestine, mature in to adults in 60 to 80 days. Average life span is 6 to 12 months.

CONTINUED

- Man is the only **reservoir of infection**.
- Faeces containing the fertilized eggs is the **infective material**.
- **Host-**Infection rates are high in children as compared to adults .High degree host- parasite tolerance present in adults and thus resistance seen.
- **Environment-** soil transmitted helminth. Other factors are temperature, oxygen, moisture, UV rays etc.
- **Human habits-** seeding of soil by eggs usually through indiscriminate open air defecation and then eggs spread through contamination of hand and food.
- **Period of communicability-** until all fertile females are destroyed and stools are negative.

SYMPTOMS

Incubation period ranges from 18 days to several weeks.

People with light infection usually have no symptoms.

Heavier infections can cause a range of symptoms including diarrhoea, abdominal pain, malaise, weakness impaired cognitive and physical development.

WHO defines heavy infection as greater than 50,000 eggs per gram of faeces.

Larvae migration causes fever, cough, sputum, asthma, skin rash, eosinophilia.

Adult worm aggregate masses can cause volvulus, intestinal obstruction while wandering worm can cause intestinal perforation, bile duct blockage.

Hookworm infection

- Defined as any infection caused by *Ancylostoma duodenale* or *Necator americanus* as single or mixed infections in the same person.
- **Problem statement-** It is seen in warm and moist climates in tropical and subtropical regions like Asia, Africa, Central and South America.

Epidemiological determinants

Agent factors - Adult worms live in small intestine of man. Eggs are passed in faeces. *A. duodenale* produces 10,000 to 30,000 eggs while *N. americanus* produces 5,000 to 10,000 eggs per day.

□ **Life cycle**- In warm moist soil, larva develops in egg and hatches in 1-2 days. Rhabditiform larva moults twice in the soil and becomes skin penetrating third stage larva in 5-10 days. Infection occurs when these larva enters the body through skin(feet). They reach lungs via blood and lymph, break alveoli, reach bronchioles and are coughed up and swallowed to reach small intestine.

□ Adult *A. duodenale* and *N. americanus* survive for about 1 and 4 yrs respectively.

Contd.

- **Reservoir-** man is the only important one.
- **Infective material-** faeces containing ova of hookworm though immediate source is soil contaminated with infective larva.
- **Period of infectivity-**as long as person harbors the parasite.
- **Host factors-**
 - Age and sex** – all ages and both sexes are susceptible. In endemic areas highest incidence is found in age group 15 – 25 yrs.
 - Nutrition** – malnourished are susceptible.
 - Host parasite balance** – in endemic areas , inhabitants develop this balance in which worm load is limited (harbor the parasite without manifesting signs)
 - Occupation** – agricultural and farming community.

ENVIRONMENTAL FACTORS

- **Soil**- larvae live in upper half inch of soil. Soil must be damp ,sandy or friable with decaying vegetation rather than clayey soil.
- **Temperature** – 24-32C is suitable for larvae which are killed at 45-50C. Eggs fail to develop below 13C.
- Oxygen, moisture and shade are required.
- **Rainfall** of 40 inches and above is favorable while floods are not.
- Indiscriminate open defecation, going barefoot, farming practices with untreated sewage and children wading in infected mud lead to infection.

SIGN and SYMPTOMS

- Incubation period for *N.americanus* is 7 weeks while that for *A.duodenale* is unpredictable ranging from 5 weeks to 9 months.
- **Effects of disease-**
 1. **Individual** –chronic blood loss and depletion of body iron stores leading to iron deficiency anemia. Child health shows retarded physical growth and development. Mothers health is affected leading to increased morbidity , low birth weight babies, abortions, still births and impaired lactation. Adults have diminished capacity for sustained hard work.
 2. **Community-** harmful effect on economy and quality of life in nutrition ,growth and development, work and productivity and medical care costs.

Prevention and control of STH

- **Primary prevention-** most effective in interrupting transmission.
- Methods are sanitary disposal of human excreta , provision of safe drinking water, food hygiene habits, use of sanitary latrines, personal hygienic behavior, wearing protective footwear , health facilities for diagnosis and treatment.
- Prevention to be effective must focus on life cycle of parasite, social, cultural and ecological circumstances in society.

SECONDARY PREVENTION

- Effective drugs are *piperazine*, *mebendazole*, *levamisole*, *pyrantel*.
- Albendazole- dose for adults and children over 2 yrs - **400 mg** as single dose. Contraindicated in pregnancy and children below 2 yrs.
- Mebendazole – **100 mg** twice daily for 3 days for all ages above 2 yrs .
- Levamisole – for many cases drug of choice . Dose – 2.5 mg/kg of body weight(max 150 mg), usually no side effects, used in mass treatment of ascariasis .
- Pyrantel- single dose of 10 mg /kg of body weight(max 1g).
- Anemia to be treated with iron and folic acid.

PREVENTION

- WHO strategy for control of STH infection is to control morbidity through periodic treatment of at risk population in endemic areas.
- People at risk- preschool aged children, school aged children , women of child bearing age, pregnant women in 2nd and 3rd trimesters, lactating mothers, adults in high risk occupations.
- If prevalence is 20 % treatment once a year
- If prevalence 50% treatment twice a year.
- Periodic deworming can be integrated with supplementation programs for preschool and with school health programs.

CONTINUED

- Recommended medicines- albendazole (**400 mg**)and mebendazole(500 mg).
 - Effective and can be easily administered by non medical persons.
 - Drugs are donated by WHO.
 - In 2011 over 300 million preschool aged and school aged children were treated with ant helminthic medicines which comprise about 30% of children at risk.
 - Global target is to eliminate morbidity due to STH in children by 2020. This will be achieved by treating at least 75% of children in endemic areas(**873 million**)