

Got Worms? Treatment of Worms and Other Parasitic Infections

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Disclosure Information

I have no financial relationships to disclose.

I will discuss the following FDA off-label use and/or
investigational use in my presentation:

- off-label parasitic infection treatments
- non-FDA approved medication use

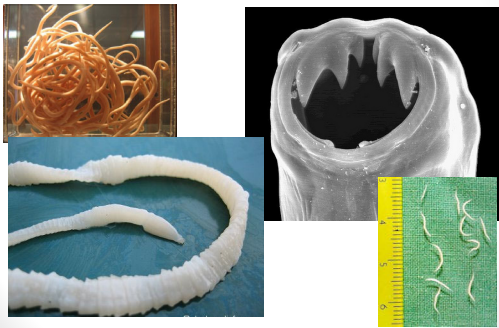
Objectives

- Review the current treatment of parasites within and outside of the US.
- Describe how to control symptoms of a patient with a parasitic infection
- Discuss current research on future treatments of parasitic infections.

Parasites

- There are hundreds if not thousands of parasitic diseases that affect humans and all life
- This presentation will focus on:
 - Chagas (American Trypanosomiasis)
 - Giardiasis
 - Leishmaniasis
 - Worms (Hookworms, Pinworms, Roundworms, Tapeworms)

Worms



Worms - Background

- Roundworms (Ascaris)
 - Transmitted via soil or fecal-oral route
 - Estimated to infect up to 1 billion people in the world
 - Symptoms range from none to intestinal blockage
- Hookworms
 - Transmitted via soil or fecal-oral route
 - Estimated to infect 500-750 million people
 - Symptoms range from none to severe anemia
- Tapeworms
 - Transmitted by eating undercooked meat
 - Symptoms range from none to GI to seizures
- Pinworms
 - Spreads easily through fecal-oral route
 - Symptoms are usually mild - itching



Worms - Treatment

- Treatment depends on the type of worm and symptoms
- Treatment may involve supportive care
- Most commonly used medications are:
 - Albendazole
 - Mebendazole
 - Ivermectin
 - Pyrantel pamoate
 - Praziquantel

Worms – Treatment (cont)

Albendazole

- Dose –
 - Adult:
 - Roundworm – 400mg x 1 dose
 - Hookworm – 400mg x 1 dose
 - Tapeworm – varies widely depending on type of tapeworm
 - Pinworm – 400mg x 1 dose and repeat in 2 weeks
 - Peds:
 - Roundworm – 400mg x 1 dose
 - Hookworm – 400mg x 1 dose
 - Tapeworm – varies widely depending on type of tapeworm
 - Pinworm – 400mg x 1 dose and repeat in 2 weeks
- Side effects – Mostly GI, headache
- Pregnancy – No
- Lactation – Use caution
- Availability – US and worldwide

Worms – Treatment (cont)

Mebendazole

- Dose –
 - Adult:
 - Roundworm – 100mg twice daily x 3 days; may repeat in 3 weeks
 - Hookworm – 100mg twice daily x 3 days; may repeat in 3 weeks
 - Tapeworm – 100mg twice daily x 3 days; may repeat in 3 weeks
 - Pinworm – 100mg x 1 dose; repeat in 14 days and 28 days
 - Peds:
 - Roundworm – 100mg twice daily x 3 days; may repeat in 3 weeks
 - Hookworm – 100mg twice daily x 3 days; may repeat in 3 weeks
 - Tapeworm – 100mg twice daily x 3 days; may repeat in 3 weeks
 - Pinworm – 100mg x 1 dose; repeat in 14 days and 28 days
- Side effects – Mostly GI, headache
- Pregnancy – Not recommended in first or second trimester
- Lactation – Use caution
- Availability – US and worldwide

Worms – Treatment (cont)

Ivermectin

- Dose –
 - Adult:
 - Roundworm – 200mcg/kg x 1 dose
 - Peds:
 - Roundworm – 150-200mcg/kg x 1 dose (use a weight based table)
- Side effects – Rash, itching, fever, GI, headache
- Pregnancy – Not recommended
- Lactation – Not recommended
- Availability – US and worldwide

Worms – Treatment (cont)

Pyrantel pamoate

- Dose –
 - Adult:
 - Hookworm – 11mg/kg x daily x 3 days (max 1gm per day)
 - Pinworm – 11mg/kg x 1 dose (max 1gm); repeat in 2 weeks
 - Peds:
 - Hookworm – 11mg/kg x daily x 3 days (max 1gm per day)
 - Pinworm – 11mg/kg x 1 dose (max 1gm); repeat in 2 weeks
- Side effects – Mostly GI, headache
- Pregnancy – Ok
- Lactation – Ok
- Availability – US and worldwide

Worms – Treatment (cont)

Praziquantel

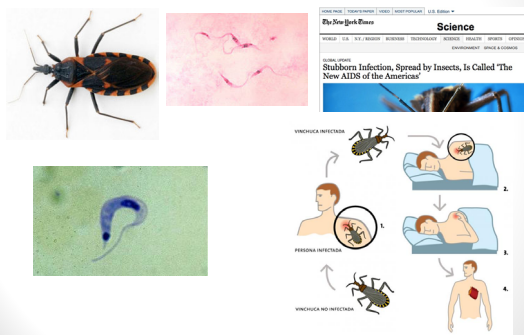
- Dose –
 - Adult:
 - Tapeworm – 5-25mg/kg x 1 dose
 - Peds:
 - Tapeworm – 5-25mg/kg x 1 dose
- Side effects – Mostly GI, headache, dizziness, malaise
- Pregnancy – Probably Ok, but not known for sure
- Lactation – Not recommended
- Availability – US and worldwide

Worms - Future Treatments

- Hookworm – vaccine in development
- Tapeworm – vaccine to treat tapeworms in pigs

- Interesting research is also being done in using worms for endocrine and inflammatory disease

Chagas Disease



Chagas Disease - Background

- Caused by the protozoal parasite *Trypanosoma cruzi*
- Transmitted by the Triatomine bug
- Found only in North and South America
- Estimated 8-10 million people affected
- Presents as a mild infection with fever and swelling at site of infection (acute phase)
- If left untreated can cause severe complications (chronic phase)
 - Arrhythmias
 - Heart failure
 - Esophageal and colon dilation
- Prevention is difficult but includes eliminating areas where triatomine bug lives



Chagas Disease - Treatment

- All patients with Chagas disease should be treated
- May also help to treat those with chronic disease
- If patients develop cardiac or GI issues from Chagas disease then symptomatic treatment of those conditions is warranted
- Treatment with antiparasitic medications leads to an estimated 60-85% cure rate, but the longer someone has been infected the less likely a cure will occur
- Antiparasitic medications commonly used are:
 - Benznidazole
 - Nifurtimox

Chagas Disease – Treatment (cont)

Benznidazole

- Dose –
 - Adult:
 - 5-7mg/kg/day divided in 2 doses for 60 days
 - Peds:
 - 5-7.5mg/kg/day divided in 2 doses for 60 days
- Side effects – allergic dermatitis, neuropathy, insomnia, weight loss
- Pregnancy – unknown
- Lactation – unknown
- Availability – Not easily accessible in the US, but widely available elsewhere
- Other considerations – take with food

Chagas Disease – Treatment (cont)

Nifurtimox

- Dose –
 - Adult:
 - 8-10mg/kg/day in 3 or 4 divided doses for 90 days
 - Peds:
 - < 40kg use 10-20mg/kg/day in 3 divided doses for 60 days
 - > 40kg use 8-10mg/kg/day in 3 divided doses for 60 days
- Side effects – GI, headache, dizziness, polyneuropathy
- Pregnancy – unknown
- Lactation – unknown
- Availability – Recently approved by the FDA (2020) and widely available elsewhere
- Other considerations – take with food

Chagas Disease - Future

- There are currently several drugs being researched around the world that are promising
- VNI, an experimental drug from Vanderbilt University, seems very promising with one study in mice exhibiting 100% cure rate and no observable side effects

Chagas Disease - Question

- Why should all patients with Chagas disease be treated even if they are currently asymptomatic?
 - A. Prevent spread to others
 - B. Prevent long-term complications
 - C. The treatments are cheap so we may as well use them up
 - D. We don't want Chagas to get into the water supply

Giardiasis



Giardiasis - Background

- Caused by the protozoal parasite *Giardia lamblia*
- Transmitted through fecal-oral route
- Infected by *Giardia* cysts
 - An infectious person excretes 1-10 billion cysts per day
 - As few as 10 cysts needed to cause an infection
- Found throughout the world
- Estimated 200 million people infected
- Presents as gastroenteritis (dehydration, diarrhea, cramps, vomiting, gas)
- Causes temporary lactose intolerance
- Many people are asymptomatic
- Without treatment symptoms typically last 4-6 weeks
- Prevention is difficult but proper sanitation is essential

Giardiasis - Treatment

- Not all patients will need treated
- Rehydration is essential in all symptomatic patients
- Antiparasitic medications commonly used are:
 - Metronidazole
 - Tinidazole
 - Nitazoxanide
 - Others
 - Paromomycin
 - Furazolidone
 - Quinacrine
 - Albendazole



Giardia – Treatment (cont)

- Metronidazole**
- Dose –
 - Adult:
 - 500mg twice daily for 5-7 days
 - Peds:
 - 15-30mg/kg/day in divided doses every 8 hours for 7 days
 - Side effects – Mostly GI, disulfiram, yeast infections
 - Pregnancy – not in the first trimester
 - Lactation – not recommended, but risks vs benefits
 - Availability – US and worldwide

Giardia – Treatment (cont)

Tinidazole

- Dose –
 - Adult:
 - 2gm x 1 dose
 - Peds: (over age of 3 years old)
 - 50mg/kg x 1 dose (2gm max)
- Side effects – Mostly GI, disulfiram, yeast infections
- Pregnancy – not in the first trimester
- Lactation – not recommended
- Availability – US and worldwide

Giardia – Treatment (cont)

Nitazoxanide

- Dose –
 - Adult:
 - 500mg every 12 hours for 3 days
 - Peds: (over age of 1 year old)
 - 100mg every 12 hours for 3 days
- Side effects – Mostly GI, headache
- Pregnancy – probably ok
- Lactation – use caution
- Availability – US and worldwide

Leishmaniasis



Leishmaniasis - Background

- Caused by the protozoal parasites of the *Leishmania* genus
- Transmitted by the bite of a sand fly
- Found throughout most of the tropical and sub-tropical world
- Estimated 12 million people infected
- Symptoms are skin sores, fever, splenomegaly
- Four types of leishmaniasis
 - Cutaneous – most common and occurs at bite-site; long time to heal
 - Diffuse cutaneous – resembles leprosy; difficult to heal
 - Mucocutaneous – ulcers spread into nose, mouth, throat
 - Visceral – liver and/or spleen and/or bone marrow involved; fatal if untreated
- Prevention is difficult
- Vaccines in development

Leishmaniasis - Treatment

- Treatment depends largely on type of leishmaniasis and genus
- Medications commonly used are:
 - Liposomal amphotericin B
 - Sodium stibogluconate
 - Meglumine antimonate
 - Miltefosine
 - Paromomycin
- Resistance to some medications is an issue in some parts of the world
- Treatment of leishmaniasis should only be done by physicians experienced in the management of the disease

Leishmaniasis – Treatment (cont)

Liposomal Amphotericin B

- Dose –
 - Adult:
 - *Visceral: 3mg/kg/day IV on days 1-5, repeated on days 14 and 21
 - Mucosal: 3mg/kg/day IV on days 1-5
 - Peds: (over age of 1 month old)
 - *Visceral: 3mg/kg/day IV on days 1-5, repeated on days 14 and 21
 - Mucosal: 3mg/kg/day IV on days 1-5
- Side effects – LOTS!! Cardio, CNS, Dermatologic, Endocrine, etc
- Pregnancy – probably ok
- Lactation – unknown; not recommended
- Availability – US and worldwide

Leishmaniasis – Treatment (cont)

Sodium Stibogluconate

- Dose –
 - Adult:
 - Visceral: 20mg Sb/kg/day IV or IM x 28 days
 - *Mucosal: 20mg Sb/kg/day IV or IM x 28 days
 - *Cutaneous: 20mg Sb/kg/day IV or IM x 20 days
 - Peds:
 - Visceral: 20mg Sb/kg/day IV or IM x 28 days
 - *Mucosal: 20mg Sb/kg/day IV or IM x 28 days
 - *Cutaneous: 20mg Sb/kg/day IV or IM x 20 days
- Side effects – aching, arthralgia, GI, QT prolongation (rare)
- Pregnancy – unknown; not recommended
- Lactation – unknown; not recommended
- Availability – US (through CDC) and worldwide

Leishmaniasis – Treatment (cont)

Meglumine antimonate

- Dose –
 - Adult:
 - Visceral: 20mg Sb/kg/day IV or IM x 28 days
 - *Mucosal: 20mg Sb/kg/day IV or IM x 28 days
 - *Cutaneous: 20mg Sb/kg/day IV or IM x 20 days
 - Peds:
 - Visceral: 20mg Sb/kg/day IV or IM x 28 days
 - *Mucosal: 20mg Sb/kg/day IV or IM x 28 days
 - *Cutaneous: 20mg Sb/kg/day IV or IM x 20 days
- Side effects – aching, arthralgia, GI, QT prolongation (rare)
- Pregnancy – unknown; not recommended
- Lactation – unknown; not recommended
- Availability – Not in the US, but most of the world

Leishmaniasis – Treatment (cont)

Miltefosine

- Dose –
 - Adult:
 - Visceral: 2.5mg/kg/day x 28 days (150mg/day max)
 - *Mucosal: 2.5mg/kg/day x 28 days (150mg/day max)
 - *Cutaneous: 2.5mg/kg/day x 28 days (150mg/day max)
 - Peds:
 - Visceral: 2.5mg/kg/day x 28 days (150mg/day max)
 - *Mucosal: 2.5mg/kg/day x 28 days (150mg/day max)
 - *Cutaneous: 2.5mg/kg/day x 28 days (150mg/day max)
- Side effects – GI (nausea and vomiting)
- Pregnancy – No! Teratogen
- Lactation – unknown; not recommended
- Availability – In the US (from CDC) and rest of the world

Leishmaniasis – Treatment (cont)

Paromomycin

- Dose –
 - Adult:
 - Visceral: 15mg/kg/day IM x 21 days
 - Cutaneous: Topically 2 times a day for 10-20 days
 - Peds:
 - Visceral: 15mg/kg/day IM x 21 days
 - Cutaneous: Topically 2 times a day for 10-20 days
- Side effects – Mostly GI, *C. difficile* associated diarrhea
- Pregnancy – unknown when given IM
- Lactation – unknown when given IM
- Availability – US and worldwide

Leishmaniasis – Future Treatment

- World Health Organization and the Centers for Disease Control are both working on vaccines against leishmaniasis.
- Vaccines are currently in Phase I trials
- Topical formulations are being looked at for cutaneous infections

Questions??

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