Global Health: Peru

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Topics:

- The Journey to Santa Clotilde
- Centro de Salud
  - Background/History
  - Hospital Capacity & Resources
  - Daily Routines
- The Medicine & Cases
  - Malaria
  - Tuberculosis
- GI bugs
Santa Clotilde

- North-eastern Peru, on the Rio Napo
- It is accessible only by boat or, less commonly, by float plane
- Nearest major city is Iquitos - accessible only by boat or by plane.
- Inhabited by indigenous people.
Santa Clotilde itself is the referral center for what is known as the “Micro Red Napo”.

The Micro Red Napo:
- A chain of rural health outposts linked by the Napo River.
- Outposts are staffed by a full-time nurse who lives on site (and sometimes a SERUM)

Santa Clotilde serves as the primary center for supplies, patient referrals, and logistical support.
Centro de Salud Santa Clotilde (CSSC)

- After WWII: the Peruvian government gave the Agricultural Station of Santa Clotilde to the Canadian Franciscans.

- 1951: the Missionary Sisters of Our Lady of the Angels of Quebec Canada
  - Developed education and health system in Santa Clotilde.
  - provided medical attention to the river population for 40 years under the direction of several nurse-nuns.
In 1986 the physician-priests Fr. Jack McCarthy and Fr. Maurice Schroeder established a de facto hospital.

Now the CSSC includes a 30-bed hospital with a general medical area, a labor and delivery, an operating room, a clinic, and a laboratory.

CSSC is the head of a network of 12 health establishments along 400km of the Napo River and serves 100+ villages and a population of over 20,000.
CSSC: Background

- Patients unable to be treated at the CSSC are stabilized and transferred to Iquitos via a one day boat trip and if needed flown to Lima, all of which is paid for by the CSSC.

- Patients are given a bill and all are expected to make a form of payment.
CSSC: Services
Laboratory

- Manual blood counts, hematocrits, platelets, thick and thin films, creatinine, stool exams, urine microscopy, pregnancy tests, ALT, AST, ESR, HIV (rapid tests only), VDRL, sputums for AFB, and agglutination test for typhoid / paratyphoid.

- They cannot do **electrolytes**, **cultures**, screening for Hep B or C, or HIV confirmatory testing.

- If needs dictate they collect blood locally and send samples to Iquitos for additional special tests, such as serology for dengue or leptospirosis. HIV confirmatory testing is done in Iquitos.
Additional Testing/Imaging

- EKG machine (broken)
- Xray machine (broken)
- Ultrasound (working)
Pharmacy

- Variety
- Individual donations - inconsistent.
- Some meds are beyond their official expiry date.
Daily Routine
The Medicine & Cases
Malaria
Malaria: Epidemiology

- Over 40% of the world's population live in malaria-endemic areas.
- Estimated 300 to 500 million cases and 1.5 to 2.7 million deaths occur each year.
- Disproportionately affects the poor:
  - 60% of malaria deaths worldwide occur in the poorest 20% of the population.
Malaria

• Which species of plasmodia causes the most cases of malaria worldwide?

A. Plasmodium falciparum

B. Plasmodium malariae

C. Plasmodium vivax

D. Plasmodium ovale

• The majority of cases and almost all deaths are caused by Plasmodium falciparum

• Plasmodium vivax, Plasmodium ovale and Plasmodium malariae cause less severe disease.
Distribution Of Plasmodium vivax

Distribution of Plasmodium falciparum
Transmission

- The parasite is transmitted by night-biting Anopheles mosquitoes.
- Warm climates with high humidity and abundant rain create favorable conditions for mosquitoes by increasing breeding areas and prolonging survival.

Source:
http://www.nature.com/nature/journal/v462/n7271/images/462298a-fl.2.jpg
Malaria: Symptoms

- >85% Nonimmune travelers will not experience symptoms until they return to their non-endemic countries.
  - 8 weeks for falciparum
  - 2-3 months for vivax
  - Most infections will be symptomatic w/in 1yr

- Fever above 38°C, rarely in classic pattern- more commonly fever pattern is hectic, chills, myalgias, HA, cough, GI sx.

- Malaria until proven otherwise
  - A delay in diagnosis can lead to catastrophic outcomes
Malaria

- Red blood cell lysis/destruction causes anemia
- Waves of parasites rupture red blood cells, which leads to classic cycles of fever and chills
Malaria

- Changes adhesive properties of infected RBCs, leading to occlusion of blood vessels and tissue hypoxia

Complications

- Severe malaria, as defined by the World Health Organization (WHO), refers to a parasitemic person with 1 or more of the following:
  - Prostration (inability to sit up without help) or impaired consciousness,
  - Seizures
  - Respiratory distress or pulmonary edema,
  - Circulatory collapse,
  - Abnormal bleeding, jaundice, hemoglobinuria or severe anemia (hemoglobin < 50 g/L or hematocrit < 15%).

- Respiratory distress, seizures and severe anemia are more common in children.

- Renal failure and jaundice occur more frequently in adults.
Diagnosis

- A high degree of suspicion
- "Gold standard" is Giemsa stain of thick and thin peripheral blood smears.
- Malaria smears permit both species identification and quantification.
- Malaria should not be excluded until at least 3 negative blood smears have been obtained within 48 hours.
- Rapid antigen detection tests (RDTs) detect parasite proteins in finger-prick blood samples.
- Can identify only *P. falciparum* and *P. vivax*.
- unreliable as tests of cure.
- Sensitivity and specificity of RDTs for the detection of falciparum malaria are over 90%. However, sensitivity falls dramatically with low level parasitemia.
Malaria Treatment
Malaria - Treatment

- P. vivax
  - Chloroquine combined with Primaquine
- P. falciparum
  - Mefloquine, and Artesunate, Primaquine
1. An infected mosquito injects sporozoites.

2. Sporozoites migrate to the liver, where they form merozoites.

3. Merozoites are released and invade red blood cells.

4. In the red blood cell, the merozoite becomes a trophozoite.

5. In the red blood cell, the trophozoite multiplies, producing new merozoites. These are released when the red blood cell ruptures, and they can infect other red blood cells.

6. Some merozoites become gametocytes.

7. The female mosquito picks up gametocytes from an infected human. The sexual cycle occurs in the mosquito, where sporozoites are formed.

Drugs effective against erythrocytic form:
- Artemisinin
- Chloroquine
- Quinine
- Mefloquine
- Pyrimethamine

Drug effective against gametocytic form:
- Primaquine

Drug effective against exoerythrocytic form:
- Primaquine

Infection can also result from use of a blood-contaminated needle.

Case: malaria with anemia

- 9yo M presented to clinic with 1 day h/o fever and body aches.

- He was diagnosed with M falciparum and discharged with Artesunate, Mefloquine and Primaquine.

- He receives one dose but does not return to clinic to complete therapy.

- He returns to clinic 2 weeks later with persistent fever, body aches and marked pallor.
Case: malaria with anemia

• Repeat testing is positive for M. vivax and Hct is 24.
• Pt is given treatment for Vivax with Chloroquine and Primaquine.
• He returns to clinic 2 day later for follow-up and is found to have a Hct of 17.
Case: malaria with anemia

- We admitted the patient, continued treatment for M. vivax and restarted treatment for M. falciparum, and gave IVFs.
- LFTs were borderline elevated. Bilirubin level was nl.
- Unable to get haptoglobin or LDH.
- RBCs appeared to have macrocytosis per lab tech. Retic count elevated.
- We also looked for a blood donor w/ O+ blood (mother breastfeeding, father candidate)
- Over the next 2 days, pt’s Hct increases to 19, then 21, but he was saturating in the mid-80s with ambulation and requiring 2-3L O2.
- Would you transfuse?
Case: malaria with anemia

- We held off on transfusion despite his symptoms b/c there is more allergic reactions, side effects when whole blood is given. And Hct was uptrending.
How do we solve the malaria problem?
WHO – Roll Back Malaria Program

- Global partnership
- 4 main components
  - Access to effective treatment
  - Preventing malaria during pregnancy
  - Reducing mosquito-human contact by widespread use of insecticide-treated bednets
  - Ensuring timely and appropriate action during malaria epidemics

Reported insecticide susceptibility status for malaria vectors, 2010–2013

Resistance status
- Confirmed resistance
- Possible resistance
- Susceptible

Data shown are for standard dose bioassays. Where multiple insecticide classes or types, mosquito species or time points were tested, the highest resistance status is shown.

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.
Not that long ago...

Tuberculosis

- 9.6 million people in 2014, including 1.2 million people living with HIV.
- 1.5 million TB deaths in 2014.
- Globally in 2014, an estimated 480,000 people developed multidrug resistant TB (MDR-TB).
Sites of TB Disease

- Pulmonary TB occurs in the lungs
  - 85% of all TB cases are pulmonary

- Extrapulmonary TB occurs in places other than the lungs, including the:
  - Larynx
  - Lymph nodes
  - Brain and spine
  - Kidneys
  - Bones and joints

- Miliary TB occurs when tubercle bacilli enter the bloodstream and are carried to all parts of the body
TB Transmission

Exposure to TB
# Latent TB vs. Active TB Disease

<table>
<thead>
<tr>
<th>LTBI</th>
<th>TB Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubercle bacilli in the body</td>
<td></td>
</tr>
<tr>
<td>TST or QFT-Gold® result usually positive</td>
<td></td>
</tr>
<tr>
<td>Chest x-ray usually normal</td>
<td>Chest x-ray usually abnormal</td>
</tr>
<tr>
<td>Sputum smears and cultures negative</td>
<td>Symptoms smears and cultures positive</td>
</tr>
<tr>
<td>No symptoms</td>
<td>Symptoms such as cough, fever, weight, loss</td>
</tr>
<tr>
<td>Not infectious</td>
<td>Often infectious before treatment</td>
</tr>
</tbody>
</table>

Source: [http://globaltb.njms.rutgers.edu/downloads/products/Mantoux_Appendices/FundamentalsofTB.ppt](http://globaltb.njms.rutgers.edu/downloads/products/Mantoux_Appendices/FundamentalsofTB.ppt)
Recommended treatment for new cases of drug-susceptible TB is a six-month regimen of four first-line drugs:
Challenges of Treatment

• Most TB is curable, but…
  • Four or more drugs required for the simplest regimen
  • 6 or more months of treatment required
  • Person must be isolated until non-infectious
  • Directly observed therapy to assure adherence/completion recommended
  • Side effects and toxicity common
    • May prolong treatment
    • May prolong infectiousness
  • Other medical and psychosocial conditions complicate therapy
    • TB may be more severe
    • Drug-drug interactions common
• Vision
  • A world free of TB. Zero deaths, disease and suffering due to TB.

• Goal
  • End the global tuberculosis epidemic.

• Indicators
  • 95% reduction by 2035 in number of TB deaths compared with 2015.
  • 90% reduction by 2035 in TB incidence rate compared with 2015.
  • Zero TB-affected families facing catastrophic costs due to TB by 2035.
Case 3

- 11yo presents with 1 day h/o fever 39C, b diarrhea. Brother with malaria. Ill-appear walk, does not respond appropriately to q the room.

- Given 3 bolus of 20cc/kg. Now able to w:

- Begins to have watery diarrhea requiring diapers. Unable to check a BMP. Negative for malaria.

- Rehydration solution

- Day 2 Able to converse better. Does not remember anything that happened.

- Stool positive: *Giardia lamblia/intestinalis*, and *Ascariasis lumbricoides*
Giardia

Infection by ingestion of cysts

Common bile duct and gallbladder may be infected

Trophozoites in upper small intestine attached to mucosa

Passed in feces

Seen in diarrhea

https://s-media-cache-ak0.pinimg.com/564x/ee/61/f2/ee61f21d0d73db9e57375a8e43a29ec.jpg
Giardia Treatment

- Effective treatments include metronidazole, tinidazole, and nitazoxanide.
Ascariasis lumbricoides

http://2.bp.blogspot.com/-Yky2lkOwZ6Y/TV6EV-XBlbPI/AAAAAALWAac/P-o4TebhKS0/s1600/ascariasis-pictures-5.jpg

Ascaris lumbricoides roundworms - post-surgery in resected bowel
Image by Dr. Vikas Arora, India

https://learnzoology.files.wordpress.com/2014/04/ascarisis-roundworms-in-the-rectum.jpg
Ascariasis lumbricoides

- The largest nematode (roundworm) parasitizing the human intestine.
  - Adult females: 20 to 35 cm
  - Adult male: 15 to 30 cm
- A female may produce approximately 200,000 eggs per day, which are passed with the feces
- Adult worms can live 1 to 2 years.
The diagram illustrates the life cycle of a parasitic worm. The stages include:

1. Fertilized egg (d): This stage is diagnostic.
2. Unfertilized egg (d): This stage will not undergo biological development.
3. Incubation in the soil.
4. Ingestion by the host.
5. Migration through the body.
6. Feces containing fertilized and unfertilized eggs.
7. Infective stage (△): The stage that can infect other hosts.

The CDC logo is present on the page, indicating the source of the information.
Ascariasis lumbricoides

- Often show no symptoms.
- Mild abdominal discomfort.
- Heavy infections can cause intestinal blockage and impair growth in children.

Source: /images/Ascaris_egg_dpdx.jpg
Treatment

- 1-3 day course of albendazole, mebendazole, or ivermectin
References

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Thank You!

- Toni Lullo
- Gita Sivasubramaniam
- CSSC staff