

## PARASITIC & DIARRHEAL INFECTIONS

### LABORATORY MEDICINE COURSE

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## BRIEF CASES



WHAT IS THE DIFFERENTIAL ?  
WHAT MICROBIOLOGY TESTS  
SHOULD YOU ORDER ?

## CASE HISTORY

A 20 MO BOY BORN TO AFRICAN IMMIGRATED PARENTS

9/05: RETURNED FROM A 6 WK TRIP TO NIGERIA

9/17: BRONX ED PRESENTATION:

FEVER (102), CHILLS, DECREASED APPETITE & FATIGUE. MOM NOTED HE WAS TAKING IN MORE FLUIDS. GIVEN TYLENOL. OLDER SIBLING ALSO STARTED TO PRESENT WITH SIMILAR SYMPTOMS. DEVELOPED RUNNY NOSE, COUGH. GIVEN AMOXICILLIN BY PMD. COUGH & RHINORRHEA RESOLVED, BUT OTHER SYMPTOMS PERSISTED. MOM ROTATED TYLENOL & MOTRIN BUT NO RELIEF  
9/20: TRANSFERRED TO CHONY FOR MANAGEMENT

## CASE

### PHYSICAL EXAM

### LABS

- VITAL SIGNS
- ✓ TEMPERATURE 38.9° C, PULSE 100 BPM, BLOOD PRESSURE 110/74 MM HG
- SKIN
- ✓ NO RASH OR LESIONS
- CHEST, HEART & ABDOMEN
- ✓ NORMAL, NEURO
- ✓ ORIENTED TO PERSON ONLY, DROWSY BUT AROUSABLE, NECK SUPPLE
- WBC COUNT 6.7
- RBC 2.92
- HGB 6.9
- HCT 21.1
- PLT 65
- URINANALYSIS
- ✓ 3+ BLOOD

TRAVEL HISTORY IS IMPORTANT

## CASE

### *P.FALCIPARUM* MALARIA

- 25% PARASITEMIA ON ARRIVAL TO CPMC (>50% PARASITEMIA REPORTED BY BRONX LEBANON HOSP)
- 9/21: PT. RECD 800 CC WHOLE BLOOD DURING EXCHANGE TRANSFUSION
- PT. STARTED ON QUININE & CLINDAMYCIN
- 9/22: 1% PARASITEMIA
- 9/23: NO PARASITES SEEN

## MICROBIOLOGY SPECIMENS

### BLOOD SMEAR PARASITOLOGY

### RESULTS

- LAVENDER TOP TUBE
- THICK & THIN SMEARS
- WRIGHT GIEMSA STAIN
- 200 to 300 OIL IMMERSION FIELDS EXAMINED
- ONE SET OF NEGATIVE FILMS WILL NOT RULE OUT MALARIA
- ✓ 4 to 5 ADDITIONAL BLOOD FILMS MUST BE EXAMINED
- ✓ EVERY 6 HR OVER 36 HR
- BLOOD SMEAR POSITIVE FOR *PLASMODIUM*
- SPECIES OF *PLASMODIUM* THAT INFECT MAN
  - ✓ *P. VIVAX*
  - ✓ *P. OVALE*
  - ✓ *P. MALARIAE*
  - ✓ *P. FALCIPARUM*

## MALARIA

- CAUSED BY PARASITE PROTOZOAN *PLASMODIUM*
- DISEASE CHARACTERIZED BY FEVER WITH RIGOR, ANEMIA & SPLENOMEGALY
- 200-300 MILLION CASES GLOBALLY
- 1-2 MILLION DEATHS GLOBALLY ANNUALLY
  - ✓ 75% ARE AFRICAN CHILDREN

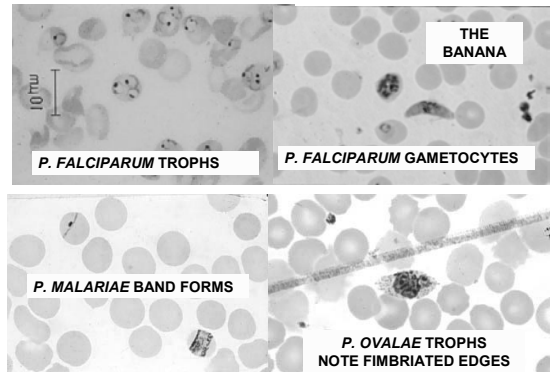
## PLASMODIA: KEY FEATURES FOR LAB IDENTIFICATION

SPECIES	HOST RBC	TROPHS	GAMETOCYTES
<i>P. vivax</i>	Enlarged & pale	Large rings Mature trophs ameboid form fill entire RBC	Round to oval; almost fill the RBC
<i>P. falciparum</i>	Normal	Small rings Multiple rings/RBC	Crescent (banana) shaped
<i>P. malariae</i>	Normal	Mature trophs: Ribbon/band shaped	Round to oval; almost fill the RBC

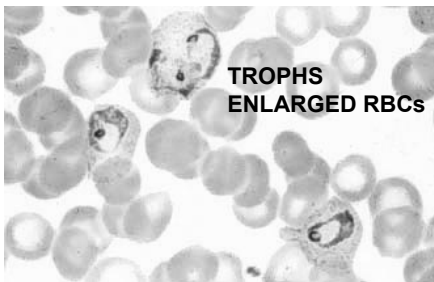
## DIAGNOSTIC TESTS

- MICROSCOPY
  - ✓ GOLD STANDARD
- MOLECULAR DIAGNOSTICS
  - ✓ SPECIES SPECIFIC ID
- ANTIBODY DETECTION - IFA
  - ✓ DETECTS IgG
  - ✓ NOT PRACTICAL FOR ROUTINE DX
- OTHER TESTS (INVESTIGATIONAL)
  - ✓ PCR rRNA ANALYSIS

## PARASITIC BEAUTY



## MALARIA – *P. VIVAX* AMOEBOID TROPHS ENLARGED RBCs



## MALARIA COMPARISON

	<i>P.falciparum</i>	<i>P.vivax</i> <i>P. ovale</i>	<i>P. malariae</i>
FEVER, CHILLS	Continuous	48 hr	72 hr
HYPNOZOITE	NO	YES	YES
ANEMIA	YES	YES	YES
SEVERITY	YES	NO	NO
THERAPY	Quinine +Doxy or Clinda Mefloquine	Chloroquine Quinine +Doxy + Primaquine	Chloroquine

## **PLASMODIUM FALCIPARUM**

- MOST AGGRESSIVE FORM OF MALARIA
- INVADES UP TO 30% ERYTHROCYTES
- ANEMIA & STICKY RBC
  - ✓ PLUGS POST CAPILLARY VENULES IN KIDNEY, LUNG, BRAIN
- HEPATOMEGALY & SPLENOMEGALY
- PRESENCE OF SICKLE CELL ANEMIA TRAIT PROTECTIVE
- 2002 *P. FALCIPARUM* GENOME WAS SEQUENCED
  - ✓ VACCINE DEVELOPMENT

## **U.S. MALARIA CASES**

<b>PLASMODIUM</b>	<b>2002</b>	<b>2003</b>
<i>P. falciparum</i>	414 (45%)	416 (49%)
<i>P. vivax</i>	277 (30%)	232 (27%)
<i>P. malariae</i>	27 (3%)	27 (3%)
<i>P. ovale</i>	28 (3%)	23 (3%)
Mixed	8 (0.9%)	10 (1%)
Undetermined	159 (17%)	149 (17%)
<b>TOTAL</b>	<b>912 (100%)</b>	<b>857 (100%)</b>

## **MALARIA ON THE HOMEFRONT**

- 7 pts in West Palm Beach within 10 miles of Palm Beach International Airport
  - ✓ Same strain *P. vivax* by multilocus genotyping
  - ✓ First reported malaria outbreak with extended transmission in the U.S. since 1986
- 11 outbreaks involving 20 cases of probable locally acquired malaria reported to CDC since 1992

MMWR (2003) 52:908-911

## **MALARIA HIGHLIGHTS**

- MICROSCOPY IS GOLD STANDARD
- SEVERAL BLOOD SAMPLES MUST BE SUBMITTED TO RULE OUT MALARIA
- *P. FALCIPARUM* IS CONSIDERED MEDICAL EMERGENCY
  - ✓ % PARASITEMIA IS HIGHER WITH *P. FALCIPARUM* INFECTION
  - ✓ DRUG RESISTANT STRAINS
- *P. VIVAX* & *P. OVALE* CAN REMAIN DORMANT AS HYPNOZOITE STAGE IN LIVER

## **BRIEF CASE**

A 4-YR-OLD WHITE FEMALE DEVELOPED PERSISTENT WATERY DIARRHEA WITH EXCESS FLATULENCE & BLOATING

- A SIBLING AND SEVERAL DAY CARE CENTER FRIENDS HAD DEVELOPED SIMILAR SYMPTOMS
- CHILD HAD NO TRAVEL HISTORY IN THE PREVIOUS 6 MTHS

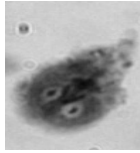
WHAT TESTS SHOULD YOU ORDER ?

## **SPECIMENS FOR MICROBIOLOGY**

- CULTURE & SENSITIVITY
- OVA & PARASITE EXAM
- ENTERO TEST
- ENZYME IMMUNOASSAY (EIA)

## GIARDIA LAB DX

- **GIARDIA LAMBLIA**
- **SPECIMENS**
  - ✓ 5-6 STOOLS REQUIRED
  - ✓ DUODENAL ASPIRATE
  - ✓ ENTERO-TEST (STRING TEST)
- **MICROSCOPY**
  - ✓ IODINE & TRICHROME STAINS
  - ✓ TROPH ("LITTLE OLD MAN")
- **ENZYME IMMUNOASSAY & DFA**



## DIAGNOSTIC TESTS: GIARDIA

- **MICROSCOPY (O & P)**
  - ✓ TRICHROME STAIN
  - ✓ DIRECT FLUORESCENT AB (DFA)
    - HIGH SENSITIVITY & SPECIFICITY
- **RAPID IMMUNOCHROMATOGRAPHIC**
  - ✓ CONFIRM BORDERLINE BY DFA
- **ENZYME IMMUNO ASSAY (EIA)**
  - ✓ SENSITIVITY 97 to 100%
  - ✓ SPECIFICITY 96 to 98%
  - ✓ PPV 95%

## GIARDIA HIGHLIGHTS

- **SPREAD BY FECAL CONTAMINATION**
  - ✓ FOOD AND WATER
  - ✓ PERSON TO PERSON
  - ✓ HAND TO MOUTH
  - ✓ ANAL INTERCOURSE
- **ANIMAL & HUMAN HOSTS**
- **ATTACHES TO INTESTINAL WALL USING "SUCKER" DISK**
- **CAN CAUSE MALABSORPTION BY SHEER NUMBERS**

## CASE

### A 32-YEAR-OLD MAN WITH AIDS

- **PROFUSE DIARRHEA UNRESPONSIVE TO ANTIMICROBIALS OR LOMOTIL**
- **REMAINED AFEBRILE**
- **AIDS STATUS NOT INDICATED**

**WHAT TESTS SHOULD YOU ORDER ?**

## THINK

### DIFFERENTIAL

- **CRYPTOSPORIDIUM**
- **ISOSPORA**
- **MICROSPORIDIUM**
- **CYCLOSPORA**

### TESTS TO ORDER

- **CULTURE & SENSITIVITY**
- **OVA & PARASITE EXAM**
  - 3 STOOL SPECIMENS
  - MODIFIED TRICHROME
- **MODIFIED ACID FAST STAIN**
- **ENZYME IMMUNOASSAY (EIA)**

## LAB DIAGNOSIS CRYPTOSPORIDIUM

- **MICROSCOPY (O & P)**
  - ✓ ACID - FAST STAIN
- **ENZYME IMMUNOASSAY (EIA)**
  - SENSITIVITY 95-97%
  - SPECIFICITY 100%
- **IMMUNOCHROMATOGRAPHIC**
- **MOLECULAR METHODS**
  - ✓ PCR (INVESTIGATIONAL)

## **CRYPTOSPORIDIUM OUTBREAK WATER!**

### **MILWAUKEE HEALTH DEPT ALERT 1993**

- COMMUNITY ILLNESS
- DEPLETION OF “OVER-THE-COUNTER” ANTI-DIARRHEAL MEDICATIONS
- SHORTAGE OF TOILET PAPER !!

CASE WAS IDENTIFIED BY AN OBSERVANT  
CLINICAL MICROBIOLOGIST  
NO TEST FOR *CRYPTOSPORIDIUM* WAS  
REQUESTED!

## **CRYPTOSPORIDIUM HIGHLIGHTS**

- CAN CAUSE SEVERE “SECRETORY” DIARRHEA IN AIDS PATIENTS
- TRANSMISSION
  - ✓ FECAL CONTAMINATION OF FOOD AND WATER
  - ✓ PERSON (OR ANIMAL) TO PERSON FROM HAND TO MOUTH

## **BRIEF CASE**

- 7 MTH OLD BLACK MALE
- SWOLLEN RIGHT SHOULDER
  - ▣ DRAINING SINUS
- TEMPERATURE 104 F
- 4 BLOOD CULTURES NEGATIVE
- FAMILY OWNED BLACK RIVER SNAKE
  - ▣ LIVED IN AQUATIUM ON FLOOR
- BABY CRAWLED ON RUG

## **MICROBIOLOGY TESTS ORDERED**

- GRAM STAIN
  - ✓ WBC
  - ✓ GNR
- DRAINING SINUS
  - ✓ CULTURE & SUSCEPTIBILITY
    - *SALMONELLA ARIZONAE*
    - ISOLATED FROM BABY & SNAKE'S STOOL SPECIMEN
    - SAME PFGE PATTERN
- BLOODS (PEDS PLUS)
  - ✓ 4 BOTTLES NEGATIVE

## **ITS THANKSGIVING IN VEGAS**

NOVEMBER 1995 LAS VEGAS, NEVADA

- AFTER EATING THANKSGIVING DINNER 7 PEOPLE HAD ACUTE ONSET
  - ✓ ABDOMINAL CRAMPS, VOMITING & DIARRHEA
  - ✓ ONE DEATH DUE TO DEHYDRATION & SEPSIS
- A 13 LB TURKEY WAS THAWED FOR 6 HRS IN A SINK OF COLD WATER & REFRIGERATED
  - ✓ STUFFED WITH BREAD, GIBLETS MIXED WITH RAW EGGS
  - ✓ REFRIGERATED 2 DAYS
- MEAT THERMOMETER NOT USED

## **SALMONELLA HIGHLIGHTS**

- APPROX. 40,000 CASES/YR (600 DEATHS)
- FOODBORNE (i.e. EGGS) ILLNESS
- >90% REPTILES HARBOR *SALMONELLA*
  - SNAKES, TURTLES, LIZARDS, GREEN IGUANAS
  - ✓ FED ANTIBIOTICS TO ENHANCE THE COLOR
  - ✓ *SALMONELLA* ISOLATED FROM STOOL & BLOOD

## CDC ANNUAL ESTIMATES FOODBORNE ILLNESS

- UNIDENTIFIED SOURCES
  - ✓ 6.5 -7.5 MILLION CASES
- 325,000 HOSPITALIZATIONS
  - ✓ 5,000 - 9,000 DEATHS
- COMPRISE ~ 50% OF DIARRHEAL DISEASES

## BRIEF CASE

AND THE OSCAR GOES TO....OUTBREAK FOR OUTSTANDING TECHNICAL ACHIEVEMENT IN MAKING NEARLY 1/3 OF 550 GUESTS SICK...

MARCH 2002, LA: GUESTS AT REGENT BEVERLY WILSHIRE HOTEL DEVELOPED VOMITING, DIARRHEA, NAUSEA & LOW GRADE FEVER

- ▣ MENU UNCLUDED SALAD, LOBSTER BISQUE, RAST BEEF, HALIBUT, ASSORTED VEG, DESSERTS...
- ▣ 24H LATER -250 PEOPLE CALLED IN SICK & WERE ILL UPTO 2 DAYS. THE EVENING HOST CHARLIE THERON WAS NOT STRICKEN..

WHAT TESTS SHOULD YOU ORDER ?

## NOROVIRUS LAB DX

- SPECIMENS
  - ✓ STOOLS
    - COLLECT WITHIN 48 TO 72HRS AFTER ONSET
  - ✓ NO RECTAL SWABS
  - ✓ VOMITUS
- RT-PCR
  - ▣ DETECTS 10<sup>2</sup> TO 10<sup>4</sup> VIRAL PARTICLES
- ENZYME IMMUNOASSAY
  - ▣ DIAGNOSTIC >4 FOLD RISE IN IgG
  - ▣ ACUTE
    - OBTAIN SPECIMEN WITHIN 5 DAYS OF SYMPTOMS
  - CONVALESCENT
    - FROM 3RD-6TH WK AFTER SYMPTOM RESOLUTION
- ELECTRON MICROSCOPY

## NOROVIRUS HIGHLIGHTS

- FIRST RECORDED EPIDEMIC OCCURED IN AN ELEMENTARY SCHOOL IN NORWALK, OHIO (1968)
- WINTER VOMITING DISEASE
- 1972 VIRAL PARTICLES DETECTED BY E.M IN STOOLS OF NIH VOLUNTEERS WHO INGESTED STOOL FILTRATES
- MAJOR CAUSE OF EPIDEMIC ACUTE & MILD GASTROENTERITIS, OR DIARRHEA

## NOROVIRUS HIGHLIGHTS

- >50% OF NON BACTERIAL GASTROENTERITIS IN US MAY BE NOROVIRUS
  - ▣ 181,000 CASES/YEAR
- SPREAD BY FECAL CONTAMINATION
  - ✓ FOOD AND WATER
    - RAW SHELL FISH, OYSTERS & CLAMS
  - ✓ PERSON TO PERSON
  - ✓ HAND TO MOUTH
  - ✓ AIRBORNE DROPLETS
- INCUBATION PERIOD: 12 TO 48 HRS
  - ▣ MEAN DURATION OF ILLNESS 12-60 HRS
- ▣ SYMPTOMS: HEADACHE, FEVER, CHILLS, MYALGIAS

## NOROVIRUS OUTBREAKS

YEAR	CASES/SOURCE	LOCATION
2004	189/SWIMMING POOL	VT
2003	700/NURSING HOMES/HOSP	MA
2002	50/HOTEL	WY
2002	200/ASSISTED LIVING CNTR	WA
2002	117/CRUISE	FL, CARRIBEAN