Diagnostic Methods in Parasitology

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Medical Parasitology Ⅱ

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Lab 1

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Introduction

Laboratory procedures play an important role in the diagnosis of parasitic infections, both for confirmation of clinical suspicion and for identifying unsuspected infections.

Why the isolation of the infecting agent and detection of specific antibodies are the major methods in bacteriology and virology, but they are of much less importance in parasitology than morphological identification of the parasite by microscopy?

Morphological diagnosis of parasites consists of *two steps.*

1- **Detection:**

Depends on collection of the appropriate samples and their examination by suitable techniques.

2- **Identification:**

Requires adequate skill and expertise in recognizing the parasite in its various stages and its differentiation from morphologically similar artifacts.

Parasite Examination

- Stool examination
- Blood examination
- Urine examination
- Biopsy (skin, muscle)
- Sputum
- Sigmoidoscopy material
- Urogenital specimen
- Culture methods
- Animal inoculation
- Xenodiagnosis
- Immunological diagnosis

Stool Examination

What is Stool?

- Human feces is called as stool.
- Faeces/feces is the plural of the Latin term faex meaning RESIDUE.
- It is the waste residue of indigestible materials from an animal's digestive tract expelled through the anus during defecation.

Collection of Fresh Stool Specimen

- All stool specimens should be collected in a suitable, clean, wide mouthed container.
- All fresh specimens should be handled carefully because each specimen represents a potential source of infectious material.

- The specimen should not be contaminated with water, urine, or disinfectants
- Properly name and always a fresh sample should be tested

STOOL EXAMINATION

- MACROSCOPIC
  - •Consistency
  - •Colour
  - •Composition
- MICROSCOPIC
  - Temporary
    - •Wet Mount
    - •Thick Smear
    - •Concentration technique
  - Permanent
- CHEMICAL
  - •FOBT
  - •Fecal Fat Test
  - •Fecal Reducing Substance
  - •Fecal pH test
- OTHERS
  - •Cellophane tape
  - •Culture

Stool Consistency

	Looks like	Consistency	Indicates
Type 1		Separate hard lumps	Very constipated
Type 2		Lumpy and sausage like	Slightly constipated
Type 3		Sausage shaped with cracks in the surface	Normal
Type 4		A smooth, soft sausage or snake	Normal
Type 5		Soft blobs with clear-cut edges	Lacking fibre
Type 6		Mushy consistency with ragged edges	Inflammation
Type 7		Liquid consistency with no solid pieces	Inflammation

MACROSCOPIC EXAMINATION

COLOUR	CONSISTENCY	COMPOSITION	Adult PARASITES
Pale=Steatorrhea (Giardia)	Liquid (Troph) Formed (Cyst) Semi formed (Cyst)	?? Blood ?? Mucus (dysentry)	*Ascaris worm *E. vermicularis *T. saginata

Stool Composition

- %75 water, %25 solid
- Undigested and unabsorbed food
- Intestinal secretion, mucous
- Bile pigment and salts
- Bacteria and inorganic material
- Epithelial cells, leukocyte

Color of Stool

1.Normal color stool

color is **brown**. This is due to the presence of bile in the stool. Normal stool color can range from **light yellow** to **brown** . If stool is **Red**, **Maroon**, **Black**, clay- colored, **Pale yellow**, or **Green** this may signify a problem.

2. Black Stools (Not Sticky, No Odor)

Causes of black stool include iron pills or bismuth-containing medications (such as, bismuth subsalicylate (Anti-acid)or Pepto-Bismol). If the stool color is dark because of any of these medications, it is typically not sticky in texture and is not foul-smelling.

3.Black Tarry, Sticky Stools

Bleeding in the stomach (from gastritis or an ulcer) or the intestines can change the color of stool. If bleeding occurs in the **stomach or the upper part of the small intestine**, the stool may turn black and sticky, and be described medically as black, tarry stool (**Melena**).Generally, black, tarry stool also is foul-smelling.

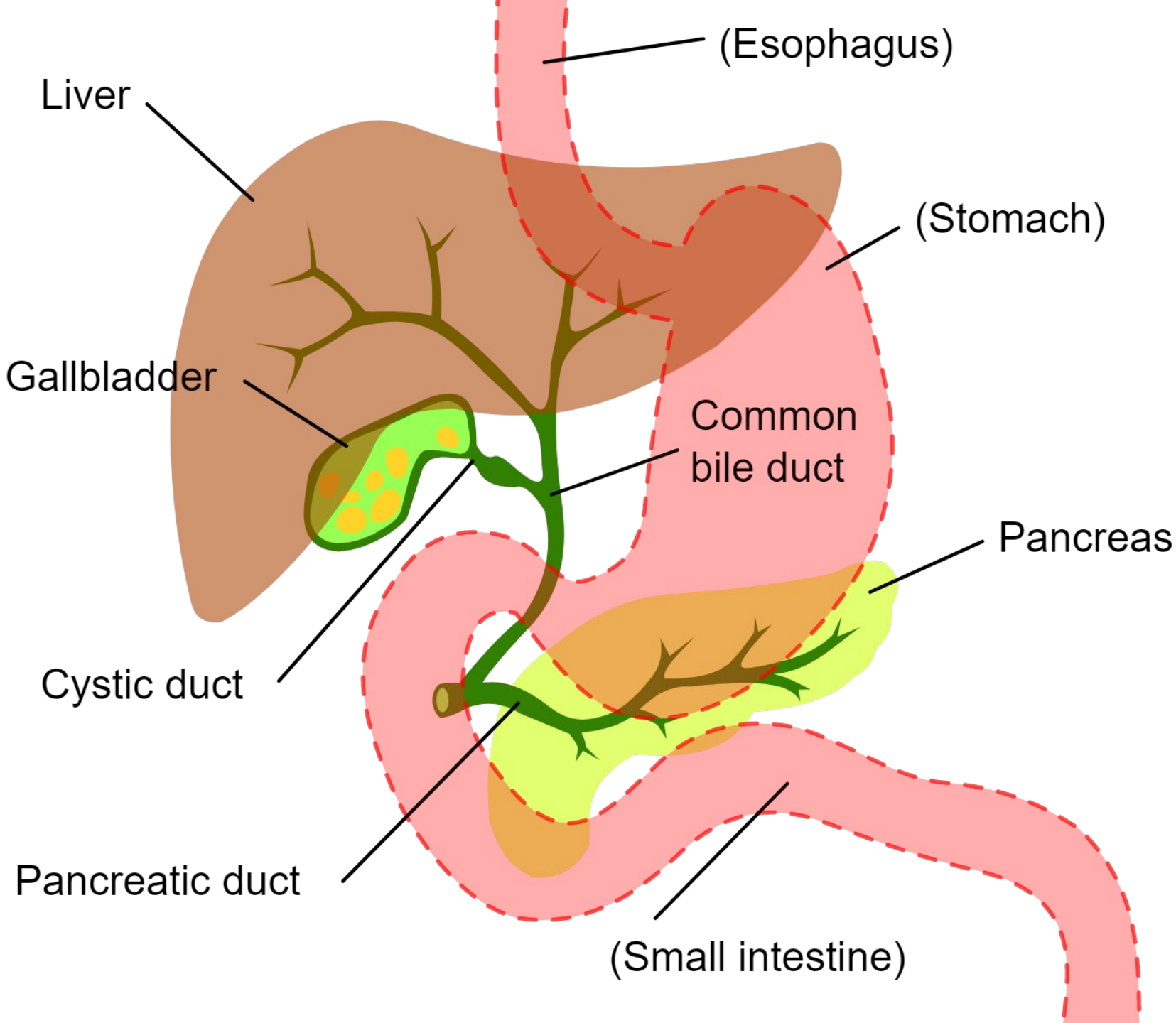
This change in color and consistency occurs because of chemical reactions to blood within the intestine that are caused by digestive enzymes within the intestines.

4.Maroon or Red Stools

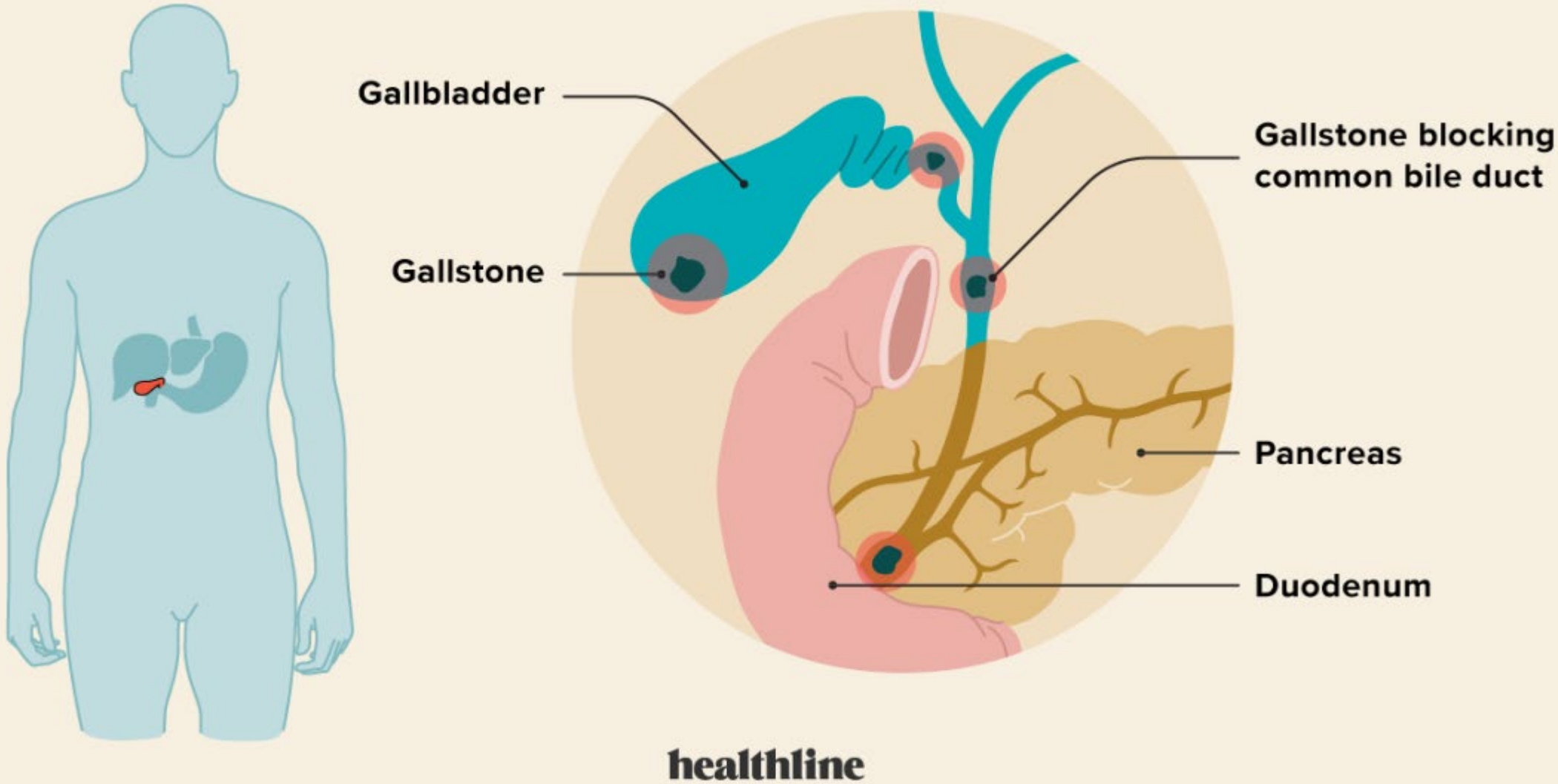
If the **bleeding** originates from **lower parts of the intestines** or in the **colon**, large amounts of **blood** within the intestines speed up transit of stool because of short distance so that there is less time for the changes to take place. The stool in this type of **bleeding** may be **dark red** or **maroon** in color. Beets, other red vegetables, cranberries, and red food dyes also can turn the stool color **red** or **maroon**.

5.Gray or Clay-Colored Stool

Stool can be **Gray or Clay-colored** if it contains little or no bile. The pale color may signify a condition (**biliary obstruction**) where the flow of bile to the intestine is obstructed, such as **obstruction of the bile duct** from a tumor or gallstone in the duct or nearby pancreas. The change of **stool color** to gray or clay typically occurs gradually as these medical conditions progress relatively slowly and stool becomes **pale** over time.


(Esophagus)
Liver
(Stomach)
Gallbladder
Common
bile duct
Pancreas
Cystic duct
Pancreatic duct
(Small intestine)

Biliary duct obstruction



6.Yellow Stool

Stool that is yellow may suggest presence of undigested fat in the stool. This can occur as a result of diseases of the pancreas that reduce delivery of digestive enzymes to the intestines (pancreatic insufficiency), such as:

- **Chronic pancreatitis** (long standing inflammation and destruction of the pancreas usually due to alcohol abuse
- **Obstruction of the pancreatic duct** that carries the enzymes to the intestines (most commonly due to pancreatic cancer).
- **Celiac disease:** Another condition that possibly may cause **yellow** and greasy stool is celiac disease (a malabsorption syndrome)
- **Weight loss medications**

7.Green Stool

When stool passes through the intestines rapidly (diarrhea), there may be little time for bilirubin to undergo its usual chemical changes, and stool can appear **green** in appearance due to rapid transit.

Eating excessive amounts of green foods, and vegetables also can cause stool color to turn more **green** than normal.

Microscopical examination of stool

1- Wet Mount

- Wet saline mounts:
- Eosin staining:
- Iodine staining

2- Thick smear

- Kato thick smear technique

3- Permanent staining

- Iron-hematoxylin stain
- Trichrome stain
- Modified trichrome stain for microsporidia:
- Modified Ziehl-Neelsen (acid-fast) stain (hot method):
- Kinyoun's acid-fast stain (cold method):
- Auramine O stainfor coccidia:

4- Concentration Methods

- Floatation Methods
- Sedimentation Methods

Chemical Tests

- **Fecal Occult Blood Test (FOBT):** Detects hidden (occult) blood in the stool, which can indicate gastrointestinal bleeding.
- **Fecal pH Test:** Measures stool acidity, useful in diagnosing carbohydrate malabsorption (e.g., lactose intolerance).
- **Fecal Reducing Substances:** Assesses undigested sugars, commonly used for detecting carbohydrate malabsorption in infants.

Chemical Tests

- **Fecal Fat Test:** Measures fat content in stool to diagnose malabsorption disorders like steatorrhea.
- **Fecal Urobilinogen:** Assesses liver function and hemolytic disorders.
- **Fecal Bile Salts:** Helps evaluate bile salt malabsorption, often in cases of ileal disease.
- **Fecal Calprotectin Test:** Measures calprotectin, a protein released by neutrophils (a type of white blood cell) in response to inflammation.
- **Fecal Lactoferrin Test:** Measures lactoferrin, a protein found in neutrophils that is released in response to inflammation.

Examination time of stool sample according to the consistency:

What is Intermediate host and definitive host?

Classification of Helminth Parasites (Parasitic Worms)

1- Nematodes (Round worms)

Ex/ *Ascaris lumbricoides, Enterobius vermicularis, trichinella spiralis)*

2- Trematodes(Fluke worms)

Ex/ *Fasciola hepatica, Fasciolopsis buski, Schistosoma hematobium)*

3- Cestodes (Tape Worms)

Ex/ *Taenia saginata, Taenia solium, Echinococcus granulosis*

References

- Paniker, C. K. J. & Ghosh, S. 2021. *Paniker's textbook of medical parasitology,* New Delhi, Jaypee Brothers Medical Publishers.