Class 6 BLI

Urine analysis

Physical examination describes the volume, color, clarity, odor, and specific gravity.

Chemical examination identifies pH, red blood cells, white blood cells, proteins, glucose, urobilinogen, bilirubin, ketone bodies, leukocyte esterase, and nitrites.

Microscopic examination encompasses the detection of casts, cells, crystals, and microorganisms.

1. Color – amber yellow, yellow (light pale to dark deep amber)
2. Appearance (Clarity) – clear
3. pH: 4.6-8 (average 6)
4. Odor: aromatic
5. Specific gravity: 1.005-1.030
6. Nitrites – negative
7. Ketones – negative
8. Crystals – negative
9. Casts -none
10. Glucose – negative
11. WBC: 0-4 per low power field
12. RBC < 2
13. RBC casts – none
14. WBC casts – none
15. Bacteria – none

Color

1. Yellow urine color – bilirubin product
2. Dark Yellow: Concentrated specimen (dehydration, exercise)
3. Red/pink urine
    a. Hematuria (blood in urine) – gross. UTI's, nephrolithiasis
    b. Foods – beets, rhubarb, blackberries, food dyes
    c. Drugs – chlorpromazine, senna, rifampin
4. Orange urine
    a. Foods – carrots, vitamin C

b. Drugs – Rifampin, coumadin
c. Bile pigments

5. Green
   a. Food – asparagus
   b. Drugs – Vitamin B
   c. Medical conditions – UTI's (Pseudomonas)
6. Blue
   a. Drugs – indomethacin, cimetidine
7. Brown
   a. Food – fava beans
   b. Drugs – Levodopa
   c. Conditions – hepatobiliary disease (hepatitis, cirrhosis)
8. Black
   a. Iron preparations

Odor

1. Foul smelling -UTI's
2. Strong, sweet smell of acetone – diabetic ketoacidosis

pH

1. Alkaline urine
   a. Can predispose to stone formation – calcium carbonate, calcium oxalate, Calcium phosphate, Magnesium phosphate (In this patient urine should be kept acidic
   b. UTI's - the most common cause of alkaline urine is due to the growth of bacteria and the breakdown of urea releasing ammonia.
   c. Respiratory alkalosis, Metabolic alkalosis
   d. Vomiting
   e. Vegetarian diet
2. Acidic urine
   a. Uric acid stones, cystine stones, oxalate stones
   b. Diabetes mellitus
   c. Diarrhea
   d. Starvation
   e. Respiratory acidosis, Metabolic acidosis

Protein

1. Is not detectable in urine
2. Elevation – proteinuria – nephrotic syndrome, Diabetes mellitus, Preeclampsia, Glomerulonephritis, Congestive heart failure, malignant hypertension, SLE, Heavy metal poisoning

Glucose

1. Screening of diabetes mellitus
2. Pregnancy

Specific gravity

1. Concentration of particles in urine – waste, electrolytes
2. Distilled water specific gravity – 1.000
3. 1.001 (diluted) and 1.010 (more concentrated)
4. Shows kidneys ability to concentrate urine
5. Increased (more concentrated) – dehydration, tumors, trauma, SIADH, Decreased renal blood flow, Fever, Vomiting, Diarrhea
6. Decreased (Diluted) – overhydration, diabetes insipidus, renal failure, Pyelonephritis, Glomerulonephritis

Nitrites

1. Most species of bacteria that colonize in the urine cause nitrates
2. Present – possible UTI

Leukocyte esterase

1. The leukocyte esterase (LE) test detects esterase, an enzyme released by white blood cells
2. Possible UTI
3. Pyuria (pus in urine). Sterile pyuria – UTI infection is due to organism that does not grow on normal urine culture. (Chlamydia, Mycobacterium tuberculosis)

Ketones

1. Produced in liver cell mitochondria in the process of ketogenesis from body fatty acids
2. Uncontrolled diabetes mellitus
3. Starvation
4. Excessive aspirin ingestion
5. Alcoholism
6. Weight restriction diets
7. Fasting
8. Anorexia nervosa
9. High proteins diets

Crystals

1. Too many minerals in urine = crystalluria
2. Types of crystals - Ammonium biurate, Bilirubin, Calcium oxalate or calcium phosphate, Cystine, Hippuric acid, Leucine, Struvite (magnesium ammonium phosphate), Tyrosine, Uric acid, Xanthine
   a. Most common crystal in urine Calcium oxalate
3. Renal stone formation
4. pH contributes to what type of crystals accumulate

Casts

1. Urinary casts are microscopic cylindrical structures produced by the kidney and present in the urine in certain disease states. They form in the distal convoluted tubule and collecting ducts of nephrons, then dislodge and pass into the urine, where they can be detected by microscopy.
2. Granular casts – Acute tubular necrosis, UTI, Glomerulonephritis, Pyelonephritis, Chronic lead poisoning, Stress
3. Fatty casts (Lipid in urine)– Glomerulonephritis, nephrotic syndrome, Diabetic nephropathy.
4. Waxy casts – nephrotic syndrome, Glomerulonephritis

5. Hyaline casts – Few can be considered normal, high number possible Glomerulonephritis, Pyelonephritis, Chronic renal failure, Congestive heart failure

RBC and Casts

1. Glomerulonephritis
2. RBC – Pyelonephritis, Renal tumors, Cystitis, Prostatitis
3. RBC casts (there is a microscopic amount of bleeding from the kidney)– Renal infection, vasculitis, Sickle cell anemia, Malignant hypertension, SLE

WBC and Casts

1. WBC (Neutrophils) – infection in urinary tract
2. WBC casts – acute pyelonephritis, Glomerulonephritis, Lupus nephritis

Additional test

1. Amylase urine test – assists in diagnosis of pancreatitis
2. Cortisol urine test – issues with adrenal gland
    - High cortisol can be present in obesity

Normal urine output: 800 to 2000 ml (average 1500 ml on average)

1. **Anuria** (less than 100 cc/day) and **oliguria** (less than 500 cc/day): Severe dehydration from vomiting, diarrhea, hemorrhage or excessive sweating; renal disease, renal obstruction, renal ischemia secondary to heart failure or hypotension, renal failure
2. **Polyuria** (greater than 2,500 - 3,000 cc/day): Alcohol or caffeine consumption, diabetes mellitus, diabetes insipidus, diuretics, increased water intake, saline or glucose intravenous therapy

Blood tests for kidney disease – Creatinine and BUN (Blood urea nitrogen)

Cancer markers

Tumor markers have traditionally been proteins or other substances that are made at higher amounts by cancer cells than normal cells. These can be found in

the blood, urine, stool, tumors, or other tissues or bodily fluids of some patients with cancer. Increasingly, however, genomic markers (such as tumor gene mutations, patterns of tumor gene expression, and nongenetic changes in tumor DNA) that are found in tumors themselves and in tumor fragments shed into bodily fluids are being used.

There are two main types of tumor markers: circulating tumor markers and tumor tissue markers.

1. Circulating tumor markers can be found in the blood, urine, stool, or other bodily fluids of some patients with cancer. Circulating tumor markers are used to:
    a. estimate prognosis
    b. determine the stage of cancer
    c. detect cancer that remains after treatment (residual disease) or that has returned after treatment
    d. assess how well a treatment is working
    e. monitor whether the treatment has stopped working
2. Biomarker testing is different from genetic testing that is used to find out if someone has inherited mutations that make them more likely to get cancer. Inherited mutations are those you are born with. Tumor tissue (or cell) markers are found in the actual tumors themselves, typically in a sample of the tumor that is removed during a biopsy. Tumor tissue markers are used to:

a. diagnose, stage, and/or classify cancer
b. estimate prognosis
c. select an appropriate treatment (e.g., treatment with a targeted therapy)
d. Oncotype DX test, which looks at the activity of 21 different genes to predict whether chemotherapy is likely to work for someone with breast cancer.

Specific cancer markers

1. Carcinoembryonic antigen (CEA)
    a. Increased: cancers of GI, breast, lung, pancreas
    b. Also – Colitis, cholecystitis, pancreatitis, diverticulitis, peptic ulcer
2. CA 19-9

a. Pancreatic carcinoma, Hepatobiliary carcinoma, Gastric cancer
b. Also – Pancreatitis, Cirrhosis,

3. CA 125
   a. Increased – **ovarian cancer**, breast cancer
   b. Also – Pregnancy, Endometriosis, Cirrhosis
4. Alpha-Feto protein (AFP)
   a. Non pregnant – ovary, colon, stomach, lung, breast cancers, lymphoma
   b. Pregnant – neural tube defects, threatened abortion, chromosomal abnormalities, fetal death, multiple fetus pregnancy
5. Human Chorionic Gonadotropin (hCG)
   a. Pregnancy hormone – placenta
   b. Testicular cancer, choriocarcinoma
6. BRCA1 and BRCA2 gene mutation
   a. Increased risk of ovarian and **breast cancer**

STOOL TESTS

Stool tests can be used to check for potential cancer of the bowel and to track causes of gastrointestinal illnesses. Stool cultures can help to identify bacteria and parasites that could be causing many problematic symptoms.

1. Ova and Parasites Examination Stool Test

a. The Ova and Parasites Examination Stool Test is used to establish the diagnosis of parasitic infestation. Concentration of material and examination of specimen for ova and parasites by conventional iodine/saline and trichrome staining.

2. Helicobacter pylori (H. Pylori) Antigen Stool Test

a. This H. Pylori Antigen Stool Test establishes the presence and possible etiologic role of Helicobacter pylori in cases of chronic gastric ulcer, gastritis, duodenal ulcer, dyspepsia, etc.

3. Occult Blood, Fecal, Immunoassay Test

a. An occult blood, fecal, immunoassay test is the qualitative detection of fecal occult blood.

4. Stool Culture Test

a. A Stool Culture Test detects the presence of disease-causing bacterial organisms including Salmonella, Shigella, Campylobacter, and Enterohemorrhagic E coli in the stool

5. Calprotectin Stool Test

a. A calprotectin stool test is used to diagnose inflammatory bowel disease (IBD), including Chron's disease and ulcerative colitis, or to differentiate IBD from irritable bowel syndrome (IBS).

6. Giardia Lamblia Stool Test, EIA

a. The Giardia Lamblia Stool Test, EIA is used in the Rapid detection of the Giardia lamblia parasite

7. Clostridium difficile Toxin B Stool Test

a. The clostridium difficile toxin B stool test is useful in diagnosing clostridium difficile toxin B.

8. Fecal Fat Stool Test

a. A fecal fat stool test, qualitative is useful in determining the presence or absence of excess fat in the stool.
    a. Steatorrhea