

Scent:

- Fecal - GI bladder fistula
- Fruity/sweet DKA
- Ammonia - alkaline fermentation

Color

- Bright Yellow
 - Vitamin tablets
 - Bilirubin!
- Red
 - Bleeding
 - *Meds:* phenytoin, phenazopyridine
 - Beetroot
- Dark brown (concentrated red orange)
 - Iron supplements
 - Prohobilin
 - Urobilin
- Turbid = bacteria or yeast, or precipitated crystals
- Foamy
 - Glucose
 - protein

Red Blood Cells

Normal Level: 0-2

Definition: # of cells/high powered field

Dysmorphic RBCs should make us think of glomerular disease

Causes:

- UTI
- Renal Stones
- GU malignancy
- Recent instrumentation (Foley placement)
- Coagulopathy
- Glomerulonephritis
- Sickle Cell Anemia
- Renal tuberculosis
- Vigorous exercise
- Contamination with menstrual blood

Note: Heme+ blood on dipstick = sensitive for hemoglobin and myoglobin - thus can be positive for rhabdomyolysis

White Blood Cells

Normal Value: 0-5

Pyuria = white blood cells in the urine (# of cells /high powered field)

Causes:

- UTI
- Indwelling catheter or recent instrumentation
- Interstitial cystitis
- Intra-abdominal inflammatory process adjacent to GU tract
- Urologic malignancy
- Contamination with vaginal secretions

Leukocyte Esterase

Normal Value: Negative

= Enzyme released by WBCs, used as qualitative measure of WBCs in urinary tract

Leuk esterase alone is more common in signs of inflammation (WBC activity) than infection

Nitrites

Normal Value: Negative

Detect present of enterobacteriaceae which convert nitrates to nitrites

note: Enterococcus does not have the ability to form nitrites

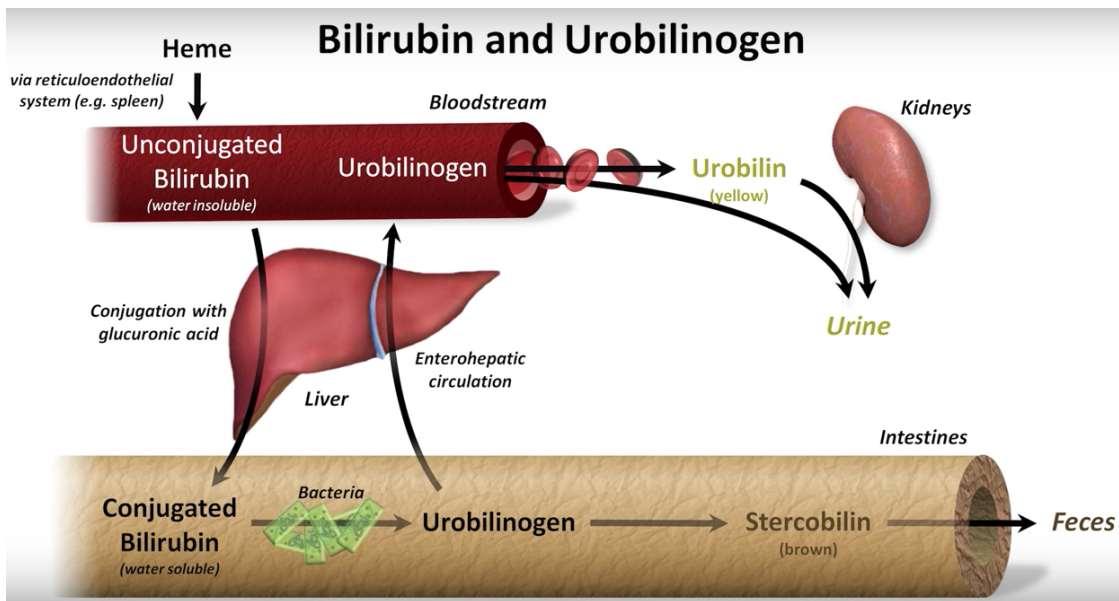
note: Cited as taking 4 hours in the bladder for bacteria to convert nitrates to nitrites, thus infants who void more frequently will often have negative nitrites

= most specific for UTI, highest positive predictive value!

Urobilinogen

Normally present in urine in small quantities

<1% of urobilinogen is passed through kidneys, the rest is excreted in feces or transported back to liver, and converted to bile



Cause of Increased Levels:

- Cirrhosis
- Hepatitis
- Hepatic necrosis
- Hemolytic anemia
- Pernicious anemia
- Malaria

Bilirubin

Normal level: Negative

Causes of Increased Levels:

Liver disease
 Biliary tract infection
 Pancreatic causes of obstructive jaundice

	Bilirubin	Urobilinogen
Hemolysis	Negative	Elevated
Biliary obstruction	Positive	Normal or decreased
Liver disease	Variable	Variable

Protein

Normal Level: Negative

A small amount of filtered plasma proteins and protein secreted by the nephron (Tamm-Horsfall protein) can be found in the urine

Proteinuria: More than 150 mg/day

Nephrotic Syndrome: Proteinuria > 3.5 gm/24 hours

Protein most sensitive on dipstick = albumin

- Dipstick usually does not pick up Ig light chains

Note that the more concentrated urine is, the more sensitive the protein screen

Causes:

- Glomerular disease (diabetic nephropathy)
- Overflow proteinuria (multiple myeloma, rhabdomyolysis, intravascular hemolysis)
- "Post Renal" proteinuria (after UTIs)

pH

Normal Range: 4.5-8.0

Low pH:

- Metabolic or respiratory **acidosis**
- Acid fruits (cranberries) also high protein diet
- Diabetes
- Diarrhea
- Starvation

High pH:

- Respiratory or metabolic **alkalosis**
- Low carb or vegetarian diet, lots of milk
- Renal calculi
- Distal RTA
- UTI secondary to urease producing organisms (Proteus, Klebsiella)

Specific Gravity

Normal Level: 1.001-1.035

Measures the concentration of dissolved solutes ==> reflection of effectiveness of renal tubules to concentrate urine

- the specific gravity of the glomerular filtrate in Bowman's space ranges from 1.007 to 1.010!

Specific gravity = weight of urine / weight of water

- thus specific gravity of water is 1.000

Decreased Specific Gravity

- Excessive fluid intake
- Acute Tubular Necrosis
- Diabetes Insipidus
- Renal failure
- Acute glomerulonephritis
- Pyelonephritis

Increased Specific Gravity

- Dehydration due to poor fluid intake, vomiting or diarrhea
- Heart failure
- Liver failure
- Inappropriate ADH secretion
- Reflects high solute concentration which may be from **glucose or protein**
 - Spec grav >1.035 = contaminated, high glucose, or high-density radiology dyes
 - tip: subtract 0.004 for every 1% glucose to determine non-glucose solute concentration

NB: specific gravity should be >1.022 after 12 hour period without food or water, if not ==> renal impairment or nephrogenic DI

General Equation: Urine osmolality (mOsm/kg) = (Urine Spec grav - 1.000) x 35

^^Doesn't work with protein or glucose in urine though

Ketones

Normal Value: Negative

Types of Ketones: acetone, acetoacetic acid, beta-hydroxybutyric acid

Presence of Ketones:

- Diabetes —> *beta-hydroxybutyrate*
- Alcoholism
- State of starvation
- Ketogenic diet
- Eclampsia
- Pregnancy

Glucose

Normal Value: Negative

Freely filtered through glomerulus, but almost all is reabsorbed in proximal tubule

Causes:

- Diabetes
- Liver disease
- Medications such as tetracycline, lithium, penicillin, cephalosporins
- Pregnancy

- Proximal tubule dysfunction (eg Fanconi syndrome)