URINE IS USEFUL!

Urine as a Diagnostic Tool

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Lecture Objectives

• Review the urinalysis – Dipstick and Microscopic analysis
• Diagnostic uses of urine
• Unconventional uses of urine
• Urine myths and Urine factoids
Urine Factoid

The word “urine” first came into usage about the 14th Century. Before that time, the now vulgar word “piss” was used, probably an onomatopoeic origin. “Urinate” was originally used only for medical description purposes. “Piss” eventually came to be used only as crude slang, leading eventually to terms such as “piss off”, “piss poor”, and the like.
Urinalysis: Proper Collection

Males: Retract foreskin / Cleanse glans with antiseptic / Begin voiding / Then place container under the stream.

Females: More difficult. Cleanse vulva / Separate labia / Begin voiding / Then catch stream. If UTI is suspected, a catheterized urine specimen is best.

Infants or Young Children: Plastic bag with adhesive collar.
Urinalysis

Specimen should be examined within one hour of collection.

If longer than one hour:
- Bacterial overgrowth
- Changes in pH
- RBC and WBC casts may disintegrate

Can refrigerate and examine later.
Urine Myth

It is urban myth that urinating on a jellyfish sting will help. In fact, at best it will have no effect, and may actually make the injury worse by stimulating the nematocysts of the jellyfish to discharge.
Composition of Urine

• Urine is 95% water
• Remaining 5% is composed of mainly urea (a nitrogenous waste product of metabolism).
• Trace amounts of vitamins, minerals, enzymes, hormones, proteins, and antibodies.
Urine Factoid: Urine in the Garden

Urine is rich in urea which can be an excellent source of nitrogen for plants. Gardeners recommend a mixture of 10-20 parts water to 1 part urine to apply to flower beds during the growing season. Urine is also useful as an accelerant for the compost pile while increasing the nitrogen content of the mulch.
Physical Exam of Urine

• Color
• Turbidity
• Specific Gravity / Osmolality
• pH
Causes of Abnormal Urine Color

Clear: Overhydration, Very dilute urine
Cloudy/Milky: Phosphaturia, Pyuria, Chyluria
Red: Hematuria, Hemoglobinuria, Myoglobinuria, Anthracyanin in beets and blueberries, Chronic lead and mercury poisoning, Compazine, Rifampin
Orange: Dehydration, Pyridium, Sulfasalazine
Yellow: Normal, Phenacetin, Riboflavin
Green/Blue: Elavil, Phenergan, Triamterene, Methylene blue, Indigo Carmine, Cimetidine
Brown: Urobilinogen, Fava beans, Metronidazole, Nitrofurantoin
Brown/Black: Hemorrhage, Laxatives, Robaxin, Aldomet, Sorbitol
Turbidity

- Cloudy urine is most likely due to phosphaturia. Excess phosphate crystals in the urine. Usually occurs after meals or ingestion of lots of milk.
- Pyuria, usually associated with UTI. Can distinguish from phosphaturia by odor or micro exam.
- Chyluria: rare cause, lymph in urine
Asparagus and Urine

“Eating asparagus makes my pee smell funny.”

Half the population develops “asparagus urine”.

Half the population cannot smell “asparagus urine”.

Methyl Mercaptan: metabolite of asparagus, found in skunk secretions.

Thioesters: Asparagusic acid
Specific Gravity and Osmolality

Varies from 1.001-1.035.
Less than 1.008 is dilute urine.
More than 1.020 is concentrated urine.
Fixed spec grav at 1.010 is a sign of renal insufficiency.
Conditions that decrease spec grav: increased fluid intake, diuretics, decreased renal concentrating ability, diabetes insipidus
Conditions that increase spec grav: decreased fluid intake, dehydration, diabetes mellitus, inappropriate ADH, IV contrast
Osmolality: varies between 50 and 1200 mOsm/L, mirrors spec grav but cannot be measured by dipstick.
Urine pH

- Varies between 4.5-8.0
- Urine pH reflects serum pH
- Renal Tubular Acidosis is the exception. Serum is acidic but urine is alkaline. Inability to acidify the urine below 5.5 after an acid load is diagnostic of RTA.
- Alkaline urine with pH greater than 7.5 suggests Proteus infection (urea splitting organism).
Urine Myth: Is it OK to drink your own urine if water is scarce?

- Aron Ralston, the guy who amputated his own arm.
- Bear Grylls on “Man vs Wild” in the Australian Outback.
- Army Field Manual recommends against it.
- Urine is 95% water. May work for 1 or 2 days.
Chemical Exam of Urine

- Glucose (30 seconds)
- Bilirubin (30 sec)
- Ketone (40 sec)
- Blood (60 sec)
- Protein (60 sec)
- Urobilinogen (60 sec)
- Nitrite (60 sec)
- Leukocytes (2 minutes)
Glucose and Ketones

- Very accurate screening for diabetes.
- If the amount of glucose filtered by the kidney exceeds the capacity for tubular reabsorption, glucose will be excreted in the urine and picked up by dipstick.
- “Renal Threshold” – 180mg/dl.
- Ketones will appear in the urine with diabetic ketoacidosis but also during pregnancy and after periods of starvation or rapid weight loss.
- False positive can occur in very acidic urine with high specific gravity.
Hematuria

• Normal urine should contain less than 3 RBC’s per HPF.
• Positive dipstick indicates hematuria, hemoglobinuria, or myoglobinuria.
• Microscopic exam can distinguish the three entities.
• False positive from menstrual blood, exercise, dehydration.
Hematuria

Nephrologic or Urologic Disease
Hematuria of nephrologic origin usually has casts in the urine and almost always has significant proteinuria.
Hematuria of urologic origin is not associated with proteinuria.
Hematuria

American Urological Association Best Practice Policy Panel on Microscopic Hematuria recommends: voided urine cytology, cystoscopy, and upper urinary tract imaging using ultrasound, CT, and/or intravenous urography.
Urine Cytology

- Evaluating the transitional cells of the urinary tract which have been sloughed into the bladder for the detection of bladder cancer.
- High specificity (90%), variable sensitivity (45-85).
- Fluorescence In Situ Hybridization (FISH)-uses fluorescently labeled monoclonal antibodies to 3 bladder CA antigens. Specificity to 97% and Sensitivity to 89%.
Figure 76-8 An abnormal enlarged cell (lower right) demonstrates three copies of chromosome 3 (red), chromosome 7 (green), and chromosome 17 (aqua) using fluorescent in situ hybridization (FISH). Homozygous deletion of band 9p21 locus (yellow) is also present. (Courtesy of Raymond Tubbs, DO, Department of Laboratory Pathology, Cleveland Clinic Foundation.)
Urine Therapy

• The use of urine for medicinal purposes can be traced to ancient Egyptian, Chinese, Aztec, and Hindu histories.
• Old Testament Proverbs 5:15: “Drink waters from thy own cistern, flowing water from thy own well.”
• The rationale is that urine is a byproduct of blood filtration or plasma ultrafiltrate.
• Urine has been used to treat multiple sclerosis, colitis, lupus, RA, cancer, hepatitis, hyperactivity, psoriasis, eczema, diabetes, herpes, mono, and adrenal failure.
• Also in children, illnesses such as flu, colds, viral infections, mumps, chicken pox, and allergies.
Urine Myth: Urine can cure cancer

American Cancer Society: “No well controlled studies published in available scientific literature support the claims that urotherapy can control or reverse the spread of cancer.”
Bilirubin and Urobilinogen

- Fresh urine must be used.
- Bilirubin in the urine will occur only with intrinsic liver disease or obstruction of the bile ducts. (Normal urine has no bilirubin)
- Urobilinogen is the end product of bilirubin metabolism. Bilirubin passes through the bile ducts where it is metabolized by intestinal bacteria to urobilinogen. Only a small amount is excreted in the urine.
- Urobilinogen in the urine greater than 2mg/dl indicates hepatic disease or hemolytic disorders.
Proteinuria

- Proteinuria may be the first indication of renovascular, glomerular, or tubulointerstitial renal disease, or may represent the flow of abnormal proteins in the urine in conditions such as multiple myeloma.
- Transient proteinuria can be common, especially in the pediatric population and resolves spontaneously in a few days. It may result from fever, exercise, or emotional stress.
- Intermittent proteinuria may be related to postural change. (Occurs only while standing).
- Persistent proteinuria should be evaluated with a 24 hour urine for protein and usually represents a glomerular pathology.
Leukocytes and Nitrites

- Leukocyte esterase test indicates pyuria.
- Nitrite positivity indicates bacteriuria. G- bacteria convert nitrates to nitrites. Specificity is over 90%. Sensitivity less.
- Studies have shown that dipstick testing is not an adequate replacement for microscopic exam of the urine.
Urine Factoids

Urolagnia: Deriving sexual pleasure from urine or urination. “Golden showers”

Omorashi: Experiencing sexual arousal from having a full bladder or a sexual attraction to someone else experiencing the sensation of a full bladder.
Microscopic Exam of Urine

- Obtain sediment
- Examine at low power (100x) and high power (400x). Oil immersion is not necessary.
- Examine for cell, casts, crystals, bacteria, yeast, and parasites.
Figure 3-13 Red blood cells from a patient with interstitial cystitis. Cells were collected at cystoscopy.
Figure 3-16 Candida albicans. Budding forms surrounded by leukocytes.
Figure 3-19 Transitional epithelial cells from bladder lavage.
Figure 3-21 Red blood cell cast.
Figure 3-23 Urinary crystals. A, Cystine. B, Calcium oxalate. C, Uric acid. D, Triple phosphate (struvite).
Figure 3-25 Streptococcal urinary tract infection with typical chain formation (arrow).
Figure 3-24 Gram-negative bacilli. Phase microscopy of Escherichia coli.
Figure 3-27 Staphylococcus aureus in typical clumps (arrow).
Figure 3-28 Trichomonad with ovoid shape and motile flagella.
Other Uses for Urine

- Urine HCG used as a pregnancy test.
- 24 hour urine collections for detecting hypercalciuria, hyperuricosuria.
- Urine drug screens
Summary

• Examination of the urine is a vital part of any general health evaluation.
• The urinalysis is an early detection tool for such varied pathology as renal disease, infections, jaundice and other liver pathology, diabetes, and urinary tract malignancies.
• Many myths surrounding the use of urine for various ailments persist.
Urine is Useful!

(So is your Urologist)

Thank You