

Urinalysis and Body Fluids CR3

Unit 3 Chemical Examination of Urine

Part 4, Urinary Proteins

Urine protein

- Small amounts of low-molecular weight protein are filtered at the glomerulus
 - Albumin has molecular weight @ 69,000 daltons
- Most of this protein is reabsorbed in the tubules
- Less than 150 mg/24 h (or 20mg/dL) is excreted
- Proteinuria - abnormal / increased amounts of protein in the urine.
 - *Most important single indicator of renal disease - with good microscopic
- Mucoprotein Tamm-Horsfall is secreted by the renal tubules is also excreted
- Urine may also contain proteins from prostatic, seminal, and vaginal secretions.

Urine protein: significance

Physiology causes (transient proteinuria)	Pathologic causes
Exercise <small>causes renal vasoconstriction</small>	Glomerular nephritis
Emotional stress	Pyelonephritis
Exposure to heat or cold	Malignant hypertension
Fever	↑ permeability of glomerulus <small>Toxins, SLE, infections, diabetes</small>
Pregnancy	Disturbance of reabsorption
Orthostatic /postural <small>Common in teens when rapid growth is occurring.</small>	Others: <small>Systemic disorders, drugs, chemicals</small>

Chemical Exam of Urine - protein

- Proteinuria in pregnancy
- Pre-eclampsia and Eclampsia
 - Another very important reason for testing urine for protein is for early identification of pregnant women who are eclamptic.
 - worst form of "toxemia of pregnancy."
 - Occurs in the latter stages of pregnancy in some women. 10% maternal mortality. 25% fetal mortality.
 - Complications include edema, hypertension, convulsions, coma, can lead to CVA, Pulmonary edema, renal failure, necrosis of the liver.
 - Early delivery of the fetus is indicated.

Chemical Exam of Urine - protein

- Primary Renal Diseases
- at one time called Bright's disease after Richard Bright - doctor in 1827 used UA as part of office exam.
 - Kidney Diseases:
 - Specific objective removed: Four characteristics associated with Bright's Disease
 - **Nephritis** - inflammation of the nephrons with hypertension, hematuria, increase in BUN, as well as proteinuria
 - **Nephrotic syndrome** - RBCs, cellular and granular casts and oval fat bodies
 - Loss of albumin from plasma, results in edema
 - Degree of protein loss has important prognostic meaning
 - Hypertention

Chemical Exam of Urine - protein

- Types of Protein
- Serum proteins
 - Albumin
 - Easiest to slip through glomerulus
 - Most likely in kidney disease
 - Detected by dipstick.
 - Precipitates in SSA
- Tamm-Horsfall protein
 - Secreted by renal tubules
 - Not found anywhere else in the body.
 - Matrix material of casts.
 - Not detected by the dipstick.
 - Precipitates in SSA

Chemical Exam of Urine - protein

- Types of Protein
- Bence-Jones protein
 - from malignant clone of antibody producing cells
 - Low molecular weight -44,000 daltons. passes easily
 - Made up of light chains (kappa or lambda)
 - Thermal sensitivity -when heated will coagulate at 40-60 degrees C (@60) and re-dissolves at boiling(100 degrees C)
 - Found in 50-80% cases of multiple myeloma - strong assoc.
 - Bence-Jones protein does not read on dipstick (to any large degree) -dipstick specific for albumin
 - Testing for Bence-Jones proteinuria not part of routine UA but the protein may be detected in a back-up protein test

Chemical Exam of Urine - protein

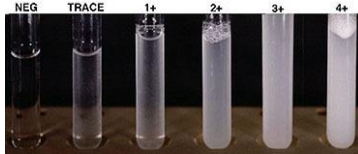
- Correlation of protein to microscopic
- Casts
 - Tamm Horsfall protein doesn't react on the dipstick,
 - However the same process that would cause increased cast production, usually results in proteinuria.
 - So if dipstick is positive for protein, lookout for casts, and if you find numerous casts in a microscopic, may want to recheck dipstick result - a QC item.

Chemical Exam of Urine - protein

- Correlation of protein to microscopic
- White cells and bacteria
 - Without protein
 - usually indicates lower tract infection
 - With protein
 - can indicate only kidney involvement
 - or simultaneous upper (kidney) and lower tract infections
- RBCs
 - large amount will cause positive protein reading

Chemical Exam of Urine - protein

- **Methods of Testing**
- **Precipitation / coagulation tests**
 - use an acid to precipitate proteins (all types)
- **3% sulfosalicylic acid**
 - Most used
 - Detects any kind of protein
 - Added to the supernatant
 - Urine will turn cloudy if protein is present.



Chemical Exam of Urine

- Principle: "protein error of indicators"
- Indicator - tetrabromophenol blue
 - most common
 - can be hard to read at the trace end
- Citrate Buffer - maintains pH 3 -quite acid
- Color ranges from yellow to blue
- Detects primarily albumin
 - Not serum globulins, Tamm Horsfall or Bence Jones
- Negative does not rule out other significant proteins



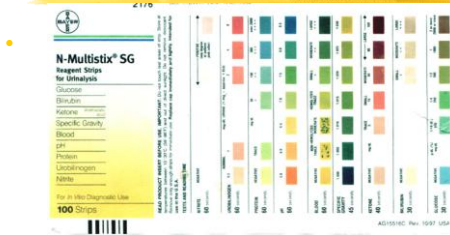
Urine Protein testing - Sources of Error

False Positives	False Negatives
Highly buffered / alkaline urine	Dilute urines
Prolonged exposure of dipstick in the urine	Elevated proteins other than albumin
Quaternary ammonium compounds (Cleaning agents alter pH)	
Phenazopyridine Analgesic medication Used with antibiotics treat UTIs Makes urine dark orange / red	
Plasma expander polyvinylpyrrolidone	
Chlorhexidine gluconate (skin cleansers)	
Blood	
Anything that stains the dipstick	

Chemical Exam of Urine

- Other means of measuring urine proteins
- Urine protein electrophoresis
 - Concentrated specimen is placed onto a membrane and placed into an electrophoretic field
 - Different protein fractions migrate at different rates
 - Used to identify abnormal protein fractions, such as Bence Jones
- Classical Bence Jones protein method
 - Filter urine while it is boiling hot
 - As it cools - watch for precipitation to form when temp @ 45-55 C
- Quantitative Protein Tests (require 24 hour specimen)
 - Kjeldahl method - classical, reference method for measurement of protein
 - Kingsbury method - biuret reagent
 - An accurate measurement of urine protein output.
 - Another alternative - urine protein to creatinine ratio

Chemical Exam of Urine



Reference Listing

- > Please credit those whose work and pictures I have used throughout these presentations.
- > Lillian Mundt & Kristy Shanahan, Graff's Textbook of Urinalysis and Body Fluids, 2nd Ed.
- > Susan Strassinger & Marjorie Di Lorenzo, Urinalysis and Body Fluids, 5th Ed.
- > Wikipedia, the free encyclopedia
 - > www.wikipedia.org
- The excellent website, University of Iowa.
 - <http://www.medicine.uiowa.edu/cme/clia/modules.asp?testID=19>
