

Urinalysis and Body Fluids α9

Unit 2; Session 8

Routine Urinalysis

Session Outline

- Historical perspective
- Importance of testing
- Basic urine composition
- Types of collection
- Timing of collection
- Urine preservatives

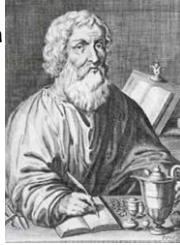
Routine Urinalysis - a historical perspective

- Urinalysis
 - Oldest lab test, still being performed
 - Cavemen and Egyptians examined urine
 - Color, clarity, odor, viscosity, sweetness



Routine Urinalysis - a historical perspective

- Hippocrates (400 BC)
 - Credited as being the Western father of modern medicine
 - wrote uroscopy book
 - Commented on abnormal urine volume



Routine Urinalysis - a historical perspective

- Middle ages: four body humors, that must be kept in balance for good health.
 - blood
 - yellow-bile
 - black bile
 - flem



Routine Urinalysis - a historical perspective

- 16-18 Century Piss-Prophets



Routine Urinalysis - a historical perspective

- 19th Century scientific advancements
 - Richard Bright
 - correlated scarred kidneys (*at autopsy*) with clinical picture of edema and urine protein *before their death*
 - *Bright's disease*



Routine Urinalysis - a historical perspective

- English physicians
 - Henry Bence-Jones
 - Associated a urine protein with patients suffering from multiple myeloma
 - Published work 1848
 - Golding Bird
 - Handbook: 'Urinary Deposits'
 - emphasized the importance of good microscopic examination.



Routine Urinalysis - a historical perspective

- Era of wet chemistries
- Pre-WWII



Routine Urinalysis - a historical perspective

- Thomas Addis
- Addis count
 - Accurate count / assessment of urine sediment
 - Urine sediment is analyzed in a hemacytometer an individual elements reported as number per 24 hours.



Routine Urinalysis - importance of urine testing

- Why test urine?
 - Renal or urinary tract disease
 - Nephritis / nephrosis, etc
 - UTIs
 - Metabolic/systemic diseases
 - Carbohydrate metabolism problems
 - Liver function problems, etc
 - Other possibilities
 - Easily obtained
 - Good way to screen asymptomatic populations for undetected disorders
 - Can be used to monitor progress of disease and effectiveness of therapy

Routine Urinalysis

- Composition - affected by diet, activity, metabolism, endocrine function & body position.
- Normal constituents
 - @ 95% water
 - 5% Solutes
 - Urea, organic & inorganic chemicals



Routine Urinalysis

- Organic
 - Uric acid - from purine catabolism
 - Urea - from protein and amino acid metabolism
 - Creatinine - by-product of muscle metabolism

Testing for Urea & Creatinine can be used to identify a fluid as being urine.

Routine Urinalysis

- Inorganic
 - Anions - (neg charged) Cl, phosphate, sulfate
 - Cations - (pos charged) Na, K ammonium
- Small or trace amounts



Routine Urinalysis

- Formed elements
 - usually not part of the original ultrafiltrate.
 - Their presence may indicate a disease process.
 - RBC
 - WBC
 - Epithelial cells (renal / transitional / bladder / squamous)
 - Hyaline casts / granular casts.. Cellular casts.
 - Crystals, mucous, bacteria, parasites, yeast

Routine Urinalysis

- **Abnormal constituents**
 - A normal constituent in an abnormal amount
 - such as increased glucose or protein
 - A formed element in increased number
 - such as increased numbers of RBC, WBC
 - A completely abnormal constituent as the result of some physical or metabolic problem
 - Bacteria, cellular casts, oval fat bodies, etc.
 - Amino acids, products of abnormal metabolism

Routine Urinalysis

- **Collection of the Urine Specimen**
 - **Container**
 - Chemically clean - no contamination, preferably sterile, *disposable, Pediatric: plastic bags with adhesive*
 - Tight-fitting lid
 - Clear plastic - ideally for routine urinalysis
 - Non-routine and 24-hour collection - use brown or dark colored containers to keep light out
 - Properly labeled - *name, date, time of collection, hosp #, doctor*
 - Delivered to lab ASAP

Collection of the Urine Specimen

- **Time**
 - **Random**
 - collected at anytime
 - *most common*, not most accurate. *Affected by diet, physical activity*
 - **First voided / first morning specimen**
 - recommended specimen for routine UA
 - most concentrated
 - most likely to reveal abnormalities.
 - Must be **FASTING** for diabetic monitoring.
 - **2 or 3 glass urine (Prostatitis Specimens)**
 - - voiding process is divided into two - three segments

Collection of the Urine Specimen

- **Methods**
 - **Mid-stream**
 - The patient begins voiding in toilet, then inserts specimen container into the continuing urine stream until the cup is @ $\frac{1}{2}$ filled.
 - **Clean Catch**
 - Prior to the voiding process, the patient performs a series of steps to cleans the external genital tissues in effort to remove contaminating bacteria .

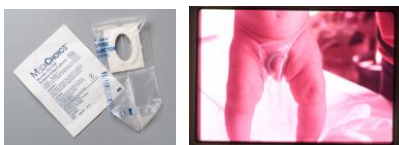
Collection of the Urine Specimen

- **Method**
 - **Timed specimens (2 hr., 12 hr., 24 hr. etc.)**
 - Patient **MUST** be given explicit instructions
 - Always begins with patient emptying their bladder
 - All urine produced and collected over a specified period of time must be properly saved.
 - Required for quantitative chemistry tests



Collection of the Urine Specimen

- **Method**
 - **Pediatric Specimen Collection**
 - **Baggie** - method OK for most testing

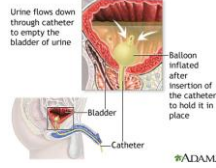


Collection of the Urine Specimen

• Method

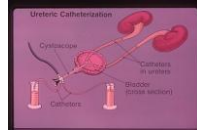
• Catheterized Specimen

- collected from a hollow tube threaded up the urethra into the bladder -
- Reasons: cultures, patient can't void, etc.



• Ureteral catheterization

- specialized catheterization to obtain samples from each (right and left) ureters



Collection of the Urine Specimen

• Method

• Suprapubic aspiration (cystocentesis)

- urine is obtained from a needle through the abdominal wall.
- Bacterial cultures (anaerobic cultures), cytology



Collection of the Urine Specimen

• Method

• Chain - of - Custody collection

- Proper collection, labeling, handling must be documented
- from the time of specimen collection until the time of receipt of laboratory results: standardized form always accompanies specimen
- Specimen must withstand legal scrutiny
 - pre employment / Continued employment
 - Sports figures
 - Military
 - Probation
- Collectors should / must be properly trained and certified

Collection of the Urine Specimen

- Specimen Rejection
 - Problems with patient / specimen ID
 - Not labeled
 - Requisition and specimen labels don't match
 - Sample collected on wrong patient
 - Problems with sample, itself
 - Contaminated
 - QNS
 - Improperly collected
 - Improperly preserved
 - Delay in transport
 - Labs have policies for specimen rejection
 - Always follow the protocol of the clinical site!

Preservation of the Urine Specimen

- Specimen Integrity
- Test within 2 hours of collection or refrigerate
- Specimens deteriorate
 - Ketones - evaporate
 - Bilirubin & Urobilinogen destroyed by light
 - Bacteria multiply
 - Metabolize / use up available glucose
 - Modify urea molecule - resulting in release of ammonia - which makes pH increasingly alkaline
 - Alkaline environment destructive

Preservation of the Urine Specimen

- Best option - test urine within 1- 2 hr
- Refrigeration at 4°C
- ASAP following collection (most desirable of preservation methods.
 - Refrigeration will increase specific gravity and cause the precipitation of amorphous crystals.
 - Dipstick testing of cold specimens - reduces speed of reactions - leading to erroneous results. ***Must allow the urine to return to room temperature before testing to prevent this.***
 - Freezing - destroys formed elements, but preserves bilirubin, urobilinogen, and porphobilinogen

Routine Urinalysis

- Chemical preservatives for routine urinalysis specimens - *very rarely would see any being used. ...each one has limitations*
 - Toluene - preserves chemical constituents, prevents bacterial multiplication
 - Formalin - kills bacteria; preserves the sediment, but affects chemical tests
 - Thymol crystals - interferes with acid precipitation test for protein
 - Boric acid - may cause crystal precipitation, doesn't inhibit bacteria well
 - Chloroform - inhibits bacterial growth, but changes the characteristics of the cellular sediment
 - C & S Transport Kit - increases specific gravity and protein, decreases pH

Routine Urinalysis

- Chemical preservatives for 24 hour urine specimens - National Committee for Clinical Laboratory Standards (NCCLS) provides guidelines.
- *Sometimes preservatives are required in the containers given to patients for the collection of 24 hour urines (chemistry department testing). These preservatives, ie. HCl can be very dangerous, and the patient must be advised as to how to handle, etc.*
 - Quality Control - Clinical and Laboratory Standards Institute (CLSI) recommendations for urine specimen requirements to ensure specimen suitability

Routine Urinalysis

- Classification of urine tests
 - Screening - detects only presence or absence of a substance
 - *report as positive or negative*
 - Qualitative (semi-quantitative) - provides a rough estimate of the amount of the substance
 - *usually report as neg, tract, 1+, etc. (Many UA dept tests)*
 - Quantitative - accurate determination of the substance being detected
 - *report as specific amt per/specific time or volume. ie mg/dL or g / 24 hr.*

Reference Listing

- > Please credit those whose work and pictures I have used throughout these presentations.
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- > Mery Haber, MD, A Primer of Microscopic Urinalysis, 2nd Ed.
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 - > <http://www.enjeypath.com/cp/Chem/Urine-Morphology/Urine-morphology.htm>
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