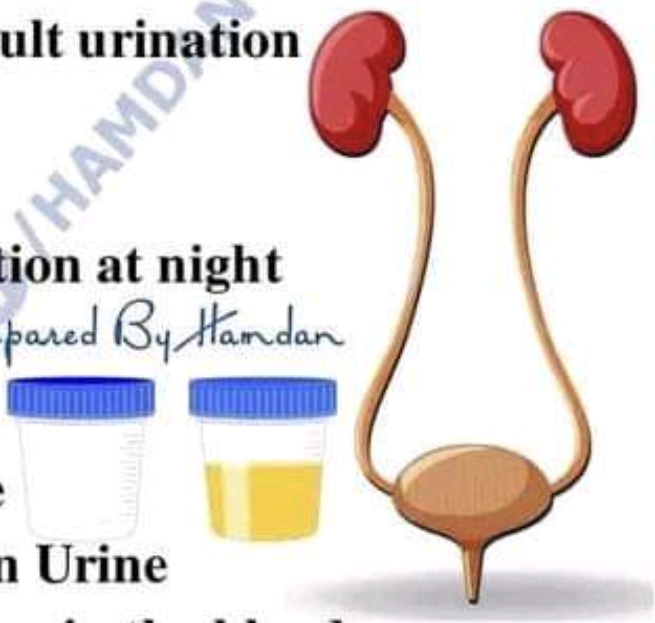
URINE

• Anuria	• No Urine production <100ml/24hrs
• Polyuria	• Excessive Urine production >1500ml/24hrs
• Oliguria	• Low urine output <400ml/24hrs
• Dysuria	• Painful or difficult urination
• Enuresis	• Bedwetting
• Glycosuria	• Sugar in Urine
• Nocturia	• Frequent urination at night
• Pyuria	• Pus in Urine
• Hematuria	• Blood in Urine
• Proteinuria	• Protein in Urine
• Ketonuria	• Ketone bodies in Urine
• Uremia	• High level of Urea in the blood
• Albuminuria	• Protein (Albumin) in the Urine
• Bilirubinuria	• Bilirubin appears in the Urine
• Fructosuria	• Presence of furctose in the Urine
• Galactosuria	• Presence of galactose in the Urine



URINALYSIS

A. Physical Examination

Includes:

1. Volume.
2. Color.
3. Odor.
4. Reaction (pH).
5. Specific gravity.

B. Biochemical Examination

Includes:

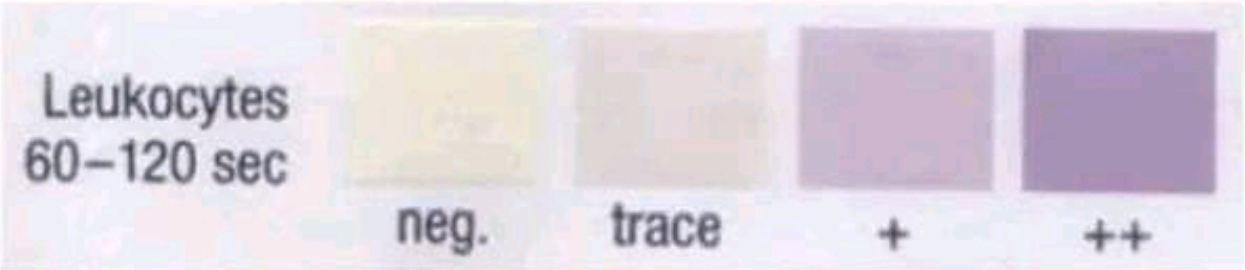
1. Proteins.
2. Sugers.
3. Ketone bodies.
4. Bile salts.
5. Bile Pigments.
6. Blood.

C. Microscopic Tests

Include:

1. Cells.
2. Crystals.
3. Casts.
4. Microorganism
5. Parasites.
6. Contamination

Dipstick Urinalysis Interpretation



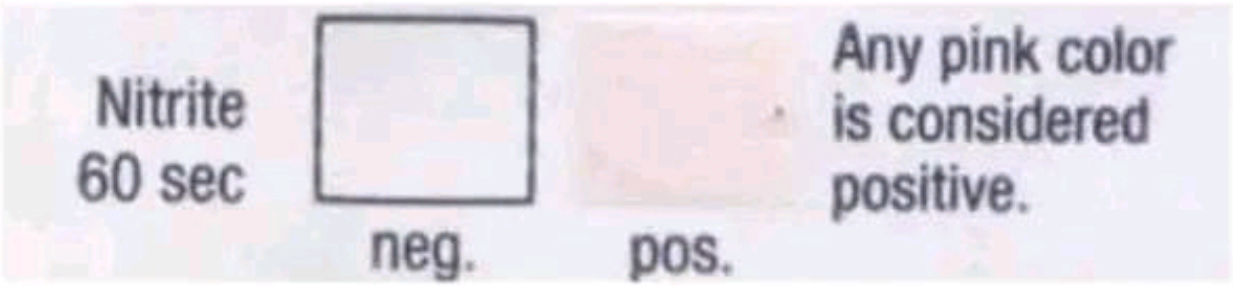
Leukocytes: Indicates infection or inflammation

Normal=negative

Dr.Sun Bunlorn✅

- Pyuria: Leukocytes in urine
- Cystitis: Bladder infection
- Pyelonephritis: Kidney infection

Dipstick Urinalysis Interpretation



Nitrite: Might indicate bacterial infection with gram-negative rods (like *E. coli*)

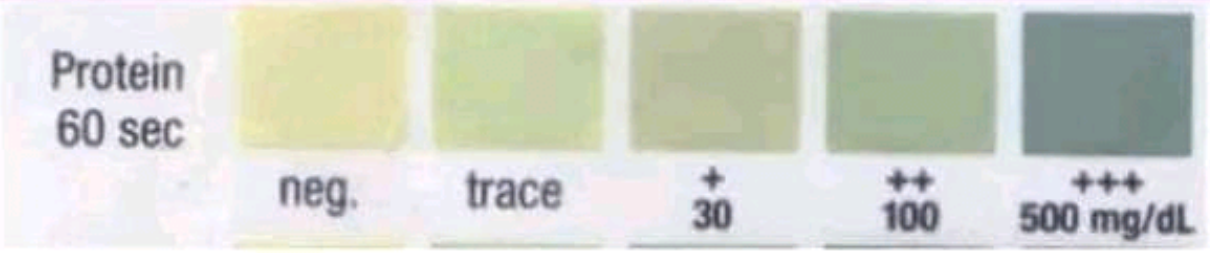
Normal=negative

Dipstick Urinalysis Interpretation

pH: large range 4.5 to 8.0

- The urine pH should be recorded, although it is seldom of diagnostic value.
  - Diet can alter pH
    - Acidic: high protein diet, ketoacidosis
    - Alkaline: vegetarian diet, UTI
  - Phosphates will precipitate in an alkaline urine, and uric acid will precipitate in an acidic urine.

Dipstick Urinalysis Interpretation

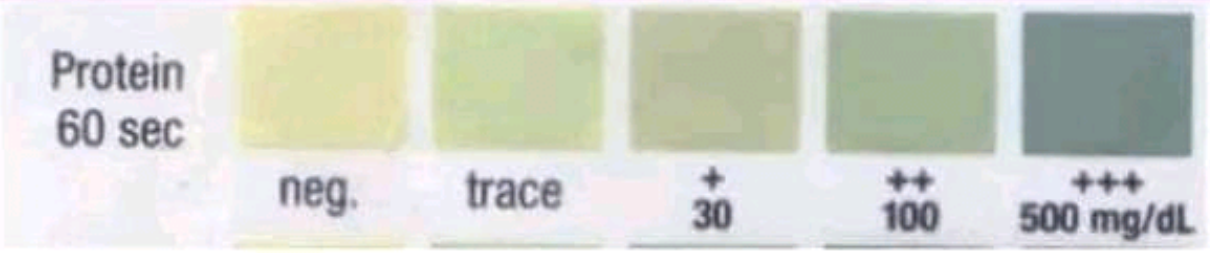


Protein: Usually proteins are too large to pass through glomerulus (Proteinuria usually represents an abnormality in the glomerular filtration barrier.)

Normal=negative

- Trace amounts normal in pregnancy or after eating a lot of protein
- Albuminuria: Albumin in urine

Dipstick Urinalysis Interpretation



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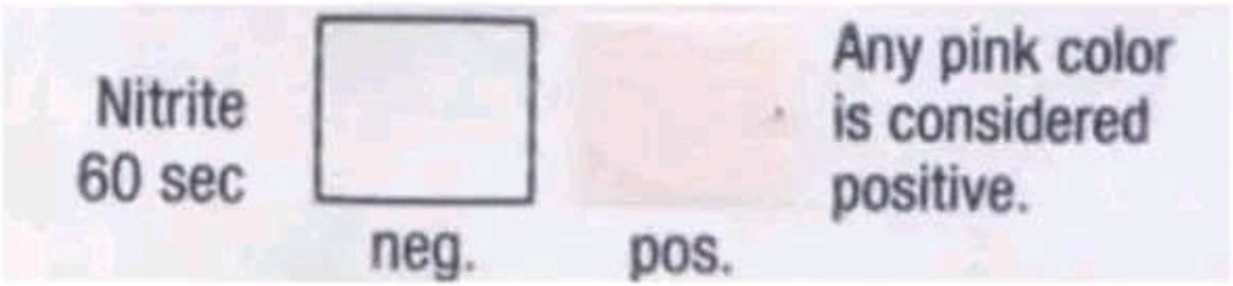


Nitrite: Might indicate bacterial infection with gram-negative rods (like *E. coli*)

Normal=negative

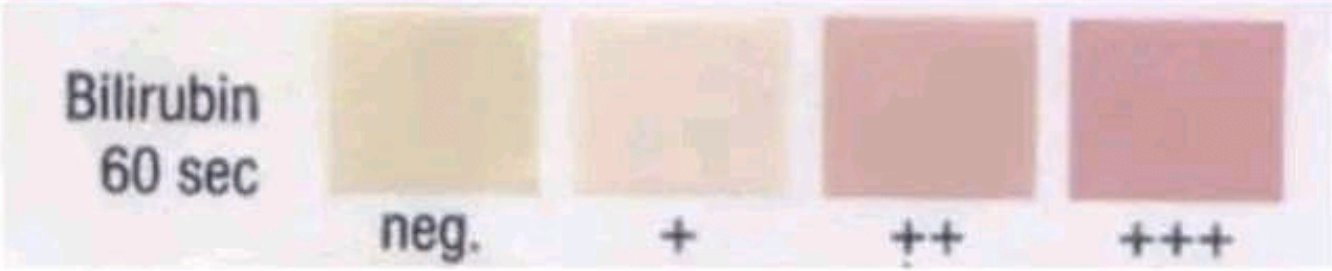
Dipstick Urinalysis Interpretation

Urobilinogen: Produced in the intestine from bilirubin.

Normal=small amount

- Absence: renal disease or biliary obstruction
- Increased in any condition that causes an increase in production or retention of bilirubin
  - Hepatitis, cirrhosis or biliary disease

Dipstick Urinalysis Interpretation



Bilirubin: indicates the presence of liver disease or biliary obstruction

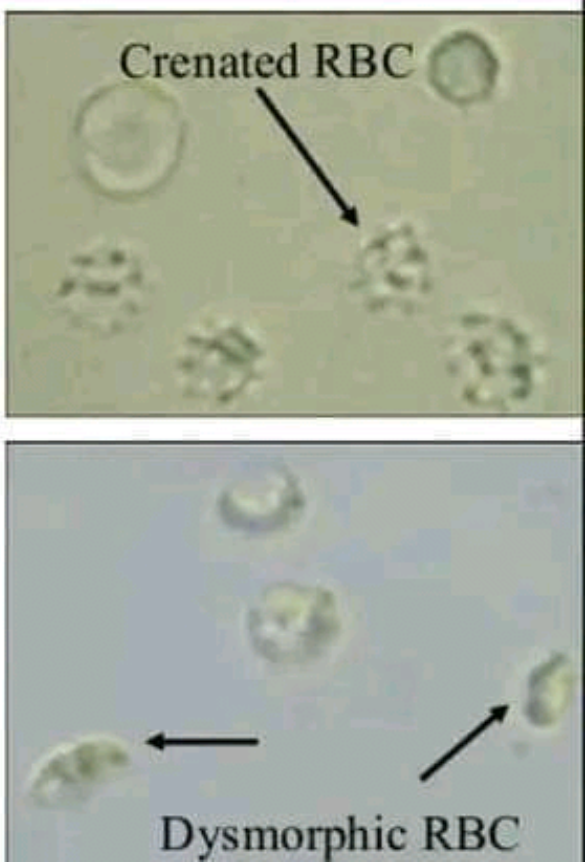
Normal=negative

- Bilirubinuria: appearance of bilirubin in urine
  - Yellow foam when sample is shake

Microscopic Examination

Hematuria: RBC in Urine

- RBC's may appear normally shaped, swollen by dilute urine or crenated by concentrated urine.
- The presence of dysmorphic (odd shaped) RBC's in urine suggests a glomerular disease such as a glomerulonephritis.



Chemical Analysis

- Sulfates: Normal constituent of urine
  - The urinary sulfate is mainly derived from sulfur-containing amino acids and is therefore determined by protein intake.
- Phosphates: Normal constituent of urine
  - Important for buffering H^+ in the collecting duct
- Chlorides: Normal constituent of urine.
  - Major extracellular anion.
  - Its main purpose is to maintain electrical neutrality, mostly as a counter-ion to sodium.
  - It often accompanies sodium losses and excesses.

Chemical Analysis

- Urea: The end product of protein breakdown
- Uric acid: A metabolite of purine breakdown

- Creatinine: Associated with muscle metabolism of creatine phosphate.

Microscopic Examination

Pyuria: WBC in Urine

- Normal:
  - Men: <2 WBCs per hi power field
  - Women: <5
- WBC generally indicate the presence of an inflammatory process somewhere along the course of the urinary tract

Microscopic Examination

Hematuria: RBC in Urine

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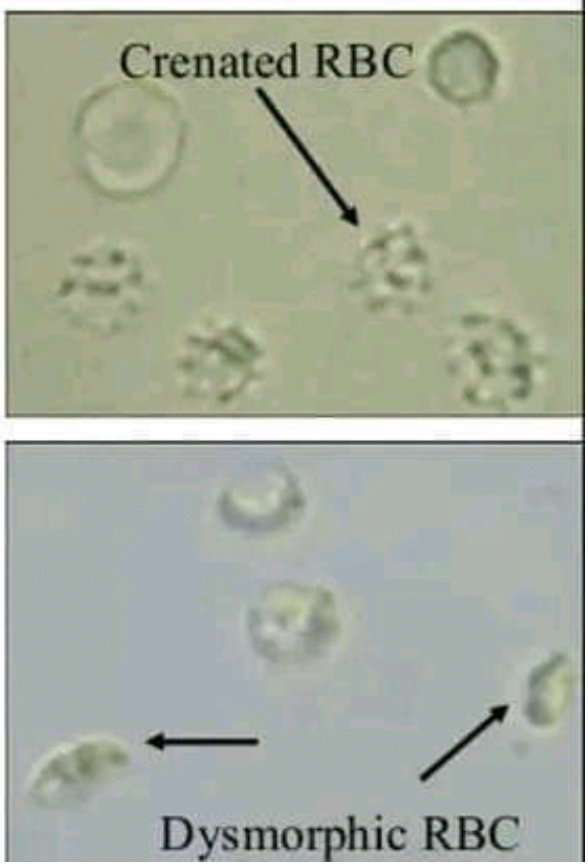


Microscopic Examination

Epithelial Cells

- Too many squamous cells: suggest contamination, poor specimen collection

Microscopic Examination Epithelial Cells

- Transitional epithelial cells originate from the renal pelvis, ureters, bladder and/or urethra.
- Large sheets of transitional epithelial cells can be seen in bladder cancer.

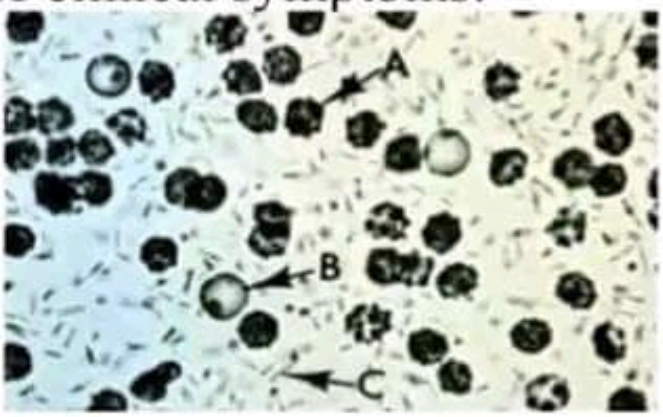
Squamous epithelial cell

Transitional epithelial cell

Microscopic Examination

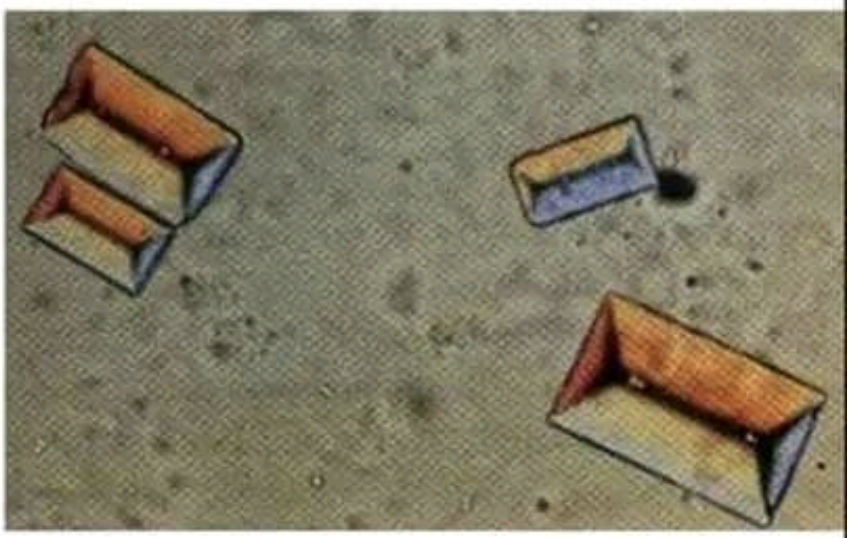
Bacteria

- Bacteria are common in urine specimens (from contamination)
- Therefore, microbial organisms found in all but the most scrupulously collected urines should be interpreted in view of clinical symptoms.



A = crenated RBC, B = RBC, C =

Struvite Crystals



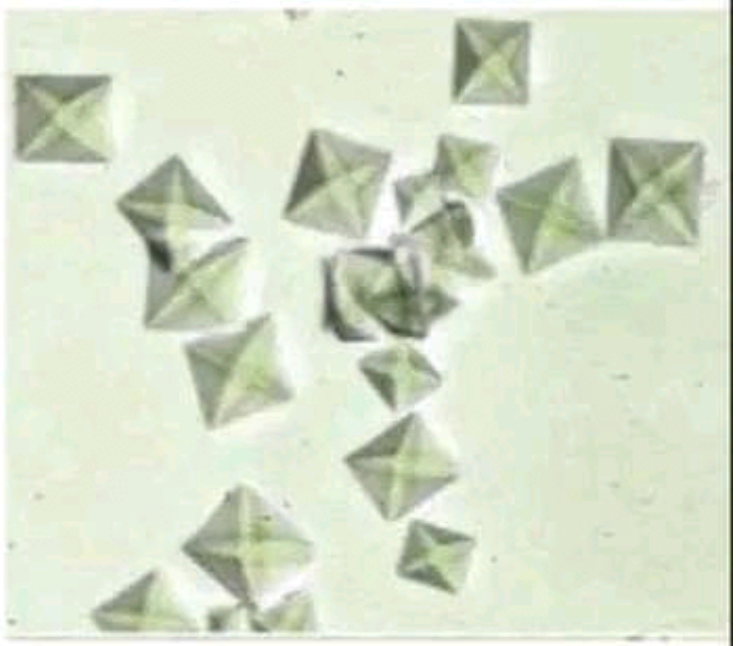
- Formation is favored in alkaline urine.
- Urinary tract infection with urease producing bacteria (eg. Proteus vulgaris) can promote struvite crystals by raising urine pH and increasing free ammonia.

Uric Acid Crystals

- High uric acid in blood (by-product of purine digestion/high protein diet)
- Associated with gout (arthritis)

Calcium Oxalate Crystals

- They can occur in urine of any pH.
- Causes: Dietary asparagus and ethylene glycol (antifreeze) intoxication



Microscopic Examination

Casts

- Casts: hardened cell fragments formed in the distal convoluted tubules and collecting ducts
- Usually pathological
- Can only be seen with microscopic examination

Hyaline Casts

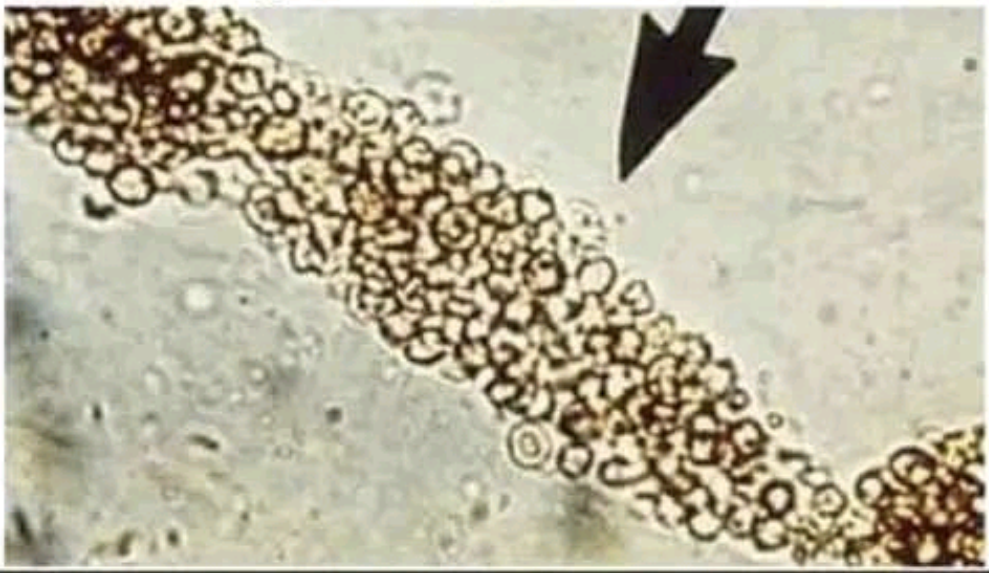
- Hyaline casts are composed primarily of a mucoprotein (Tamm-Horsfall protein) secreted by tubule cells.

Hyaline Casts appear Transparent

- Causes: Low flow rate, high salt concentration, and low pH, all of which favor protein denaturation and precipitation of the Tamm-Horsfall protein.

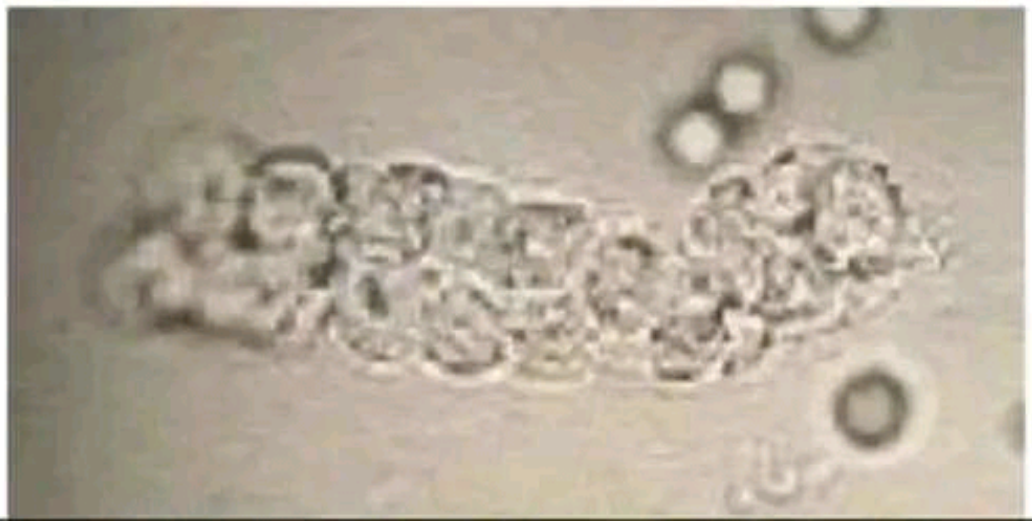
Red Cell Casts

- Red blood cells may stick together and form red blood cell casts.
- Indicative of glomerulonephritis, with leakage of RBC's from glomeruli, or severe tubular damage.



White Cell Casts

- Usually indicates pyelonephritis (kidney infection)
- Other causes: Interstitial Nephritis (inflammation of the tubules and the spaces between the tubules and the glomeruli.)



IVD

+30 °C
+2 °C

2011-02

23054941

LOT

Specific Gravity Densidad Densidade 60 sec/seg.	1.000	1.005	1.010	1.015	1.020	1.025	1.030		
pH 60 sec/seg.	5.0	6.0	6.5	7.0	8.0	9.0			
Leukocytes Leucocitos 60–120 sec/seg.	neg.	ca. 15	ca. 75	ca. 125	ca. 500	Leuko/µL			
Blood/Hemoglobin/ Sang(re)(ue)/Hemoglobina 60 sec/seg.	neg.	ca. 5-10	ca. 10	ca. 25	ca. 25	ca. 50	ca. 50	ca. 250 Ery/µL	
Nitrite/Nitrito/Nitritos 60 sec/seg.	neg.	+	++						
Ketones/ C.Cetónicos 60 sec/seg.	neg.	5 (0.5)	15 (1.5)	50 (5)	150 (15)	mg/dL (mmoL/L)			
Bilirubin/Bilirrubina/ 60 sec/seg.	neg.	+	++	+++					
Urobilinogen(o)/ Urobilinogênio 60 sec/seg.	normal	1 (17)	4 (70)	8 (140)	12 (200)	mg/dL (µmol/L)			
Protein/Proteínas/ Proteínas 60 sec/seg.	neg.	15 (0.15)	30 (0.3)	100 (1)	300 (3)	1000 (10)	mg/dL (g/L)		
Glucose/Glucosa/ Glicose 60 sec/seg.	normal	100 (5.5)	300 (17)	1000 (55)	mg/dL (mmol/L)				

Types of urine sample

Sample type	Sampling	Purpose
Random specimen	No specific time most common, taken anytime of day	Routine screening, chemical & FEME
Morning sample	First urine in the morning, most concentrated	Pregnancy test, microscopic test
Clean catch midstream	Discard first few ml, collect the rest	Culture
24 hours	All the urine passed during the day and night and next day Ist sample is collected.	used for quantitative and qualitative analysis of substances
Postprandial	2 hours after meal	Determine glucose in diabetic monitoring
Supra-pubic aspired	Needle aspiration	Obtaining sterile urine

Table 1. Urinalysis Results

Test	Usual Range	Indicators of Infection	Accuracy
Bacteria	Absent	Any amount	Low sensitivity,[a] high specificity[b]
Leukocyte esterase	Absent	Positive = pyuria, presence of WBCs in urine	High sensitivity, low specificity
WBC	<5	Pyuria: WBC >10	High sensitivity, low specificity
Nitrite	Absent	Positive = presence of bacteria that reduce nitrate	Low sensitivity, high specificity
RBC	<5	Hematuria common in infection	Low sensitivity, high specificity
Epithelial cells	<5	<5 = good urine sample	High epithelial cells indicate contamination with skin flora
pH	4.5-8	pH ↑ if urea-splitting organism (e.g., *Proteus mirabilis*) is present	Low specificity (there are many other causes of alkaline urine)

[a] *Sensitivity = likelihood of positive test when disease is present.*
[b] *Specificity = likelihood of negative test when disease is not present.*
Source: Reference 1.

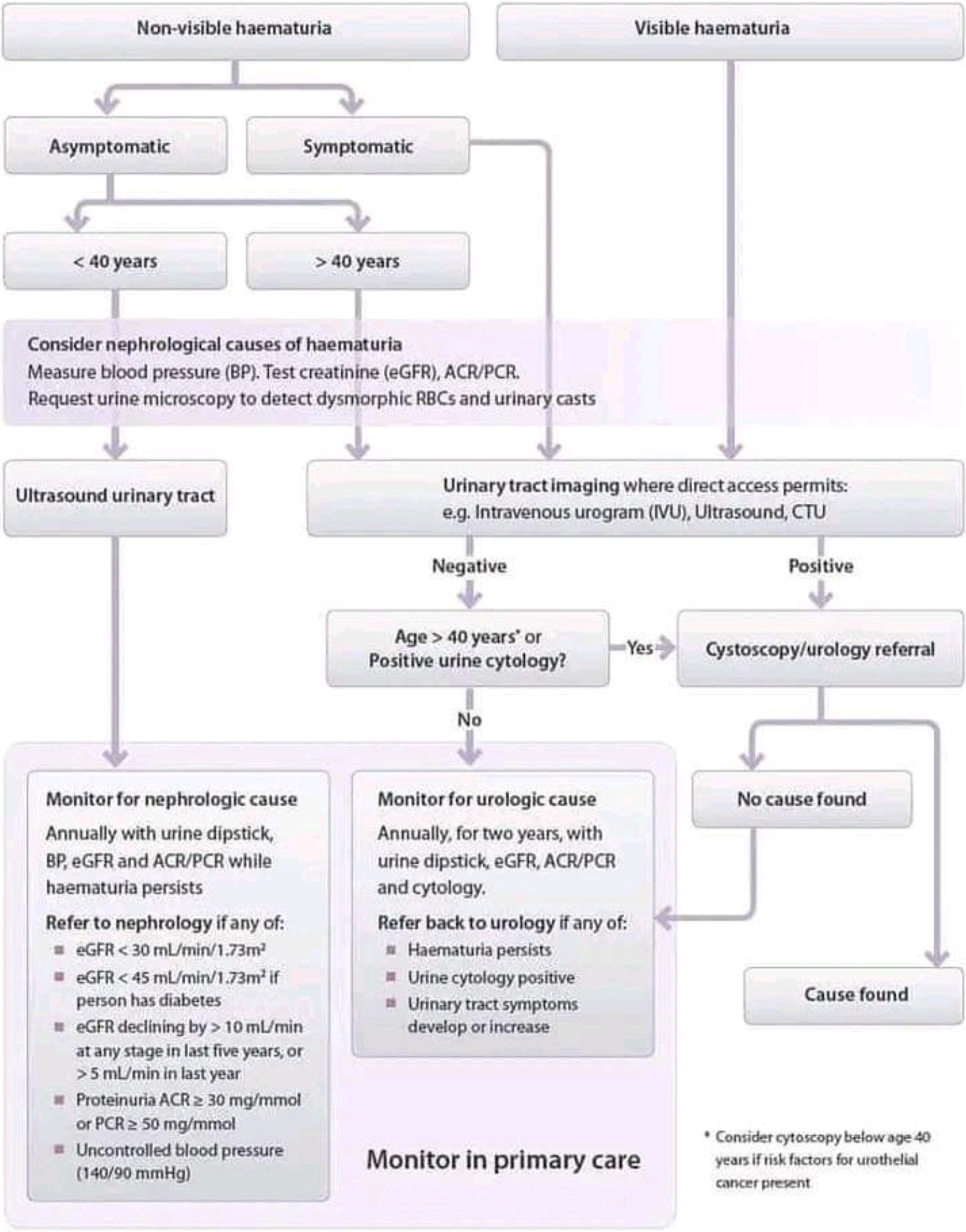

Non-visible haematuria
Visible haematuria
Asymptomatic
Symptomatic
< 40 years
> 40 years
Consider nephrological causes of haematuria
Measure blood pressure (BP). Test creatinine (eGFR), ACR/PCR.
Request urine microscopy to detect dysmorphic RBCs and urinary casts
Ultrasound urinary tract
Urinary tract imaging where direct access permits:
e.g. Intravenous urogram (IVU), Ultrasound, CTU
Negative
Positive
Age > 40 years* or
Positive urine cytology?
Yes
Cystoscopy/urology referral
No
No cause found
Cause found
Monitor for nephrologic cause
Annually with urine dipstick, BP, eGFR and ACR/PCR while haematuria persists
Refer to nephrology if any of:
eGFR < 30 mL/min/1.73m²
eGFR < 45 mL/min/1.73m² if person has diabetes
eGFR declining by > 10 mL/min at any stage in last five years, or > 5 mL/min in last year
Proteinuria ACR ≥ 30 mg/mmol or PCR ≥ 50 mg/mmol
Uncontrolled blood pressure (140/90 mmHg)
Monitor for urologic cause
Annually, for two years, with urine dipstick, eGFR, ACR/PCR and cytology.
Refer back to urology if any of:
Haematuria persists
Urine cytology positive
Urinary tract symptoms develop or increase
Monitor in primary care
* Consider cytoscopy below age 40 years if risk factors for urothelial cancer present

Table 1: Urine studies to order and interpret in four common clinical scenarios

Clinical Scenario:	Order:	Calculate:	Interpretation:
Acute Kidney Injury	Urine Sodium OR Urine Urea Urine Creatinine Serum Sodium OR Serum Urea Serum Creatinine	FENa: $\frac{Na_{urine} \times Cr_{serum}}{Na_{serum} \times Cr_{urine}}$ OR FEUrea: $\frac{Urea_{urine} \times Cr_{serum}}{Urea_{serum} \times Cr_{urine}}$	If FENa <1%, consider pre-renal and other causes If FEUrea <35%, consider pre-renal and other causes
Hyponatremia	Urine Sodium Urine Osmolality Serum Osmolality	Assess RAAS and ADH action	If Na_{urine} is low, RAAS is likely activated If Osm_{urine} is high, ADH is activated
Hypokalemia	Urine Potassium Urine Osmolality Serum Potassium Serum Osmolality	TTKG: $\frac{K_{urine} \times Osm_{serum}}{K_{serum} \times Osm_{urine}}$	If TTKG is high, consider renal potassium losses
Normal anion gap metabolic acidosis	Urine Sodium Urine Potassium Urine Chloride	UAG: $Na_{urine} + K_{urine} - Cl_{urine}$	If UAG is positive, consider renal causes of acidosis If UAG is negative, consider GI causes of acidosis