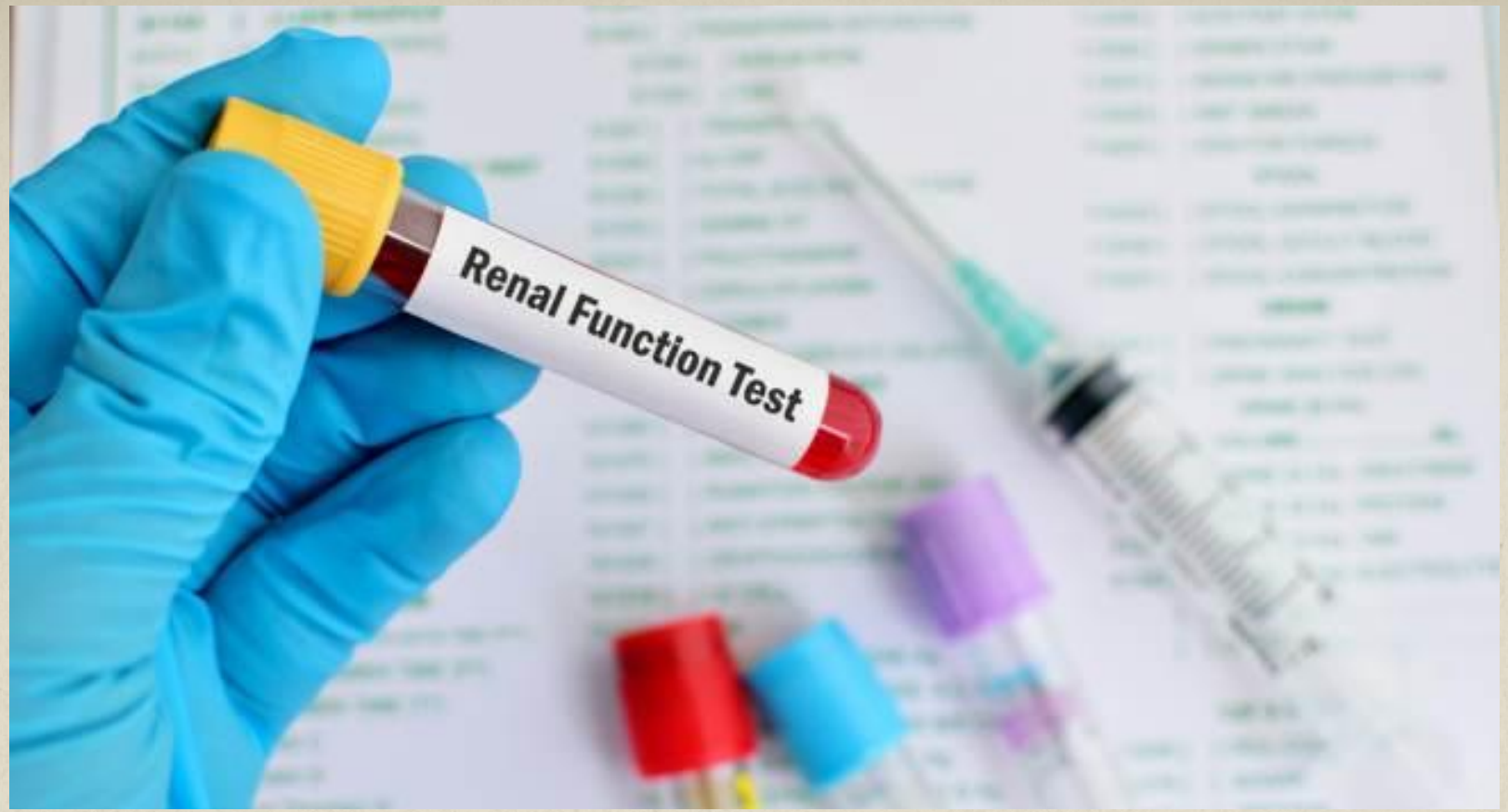


RENAL FUNCTION TEST

HIMANSHU PANERU

CONTENT

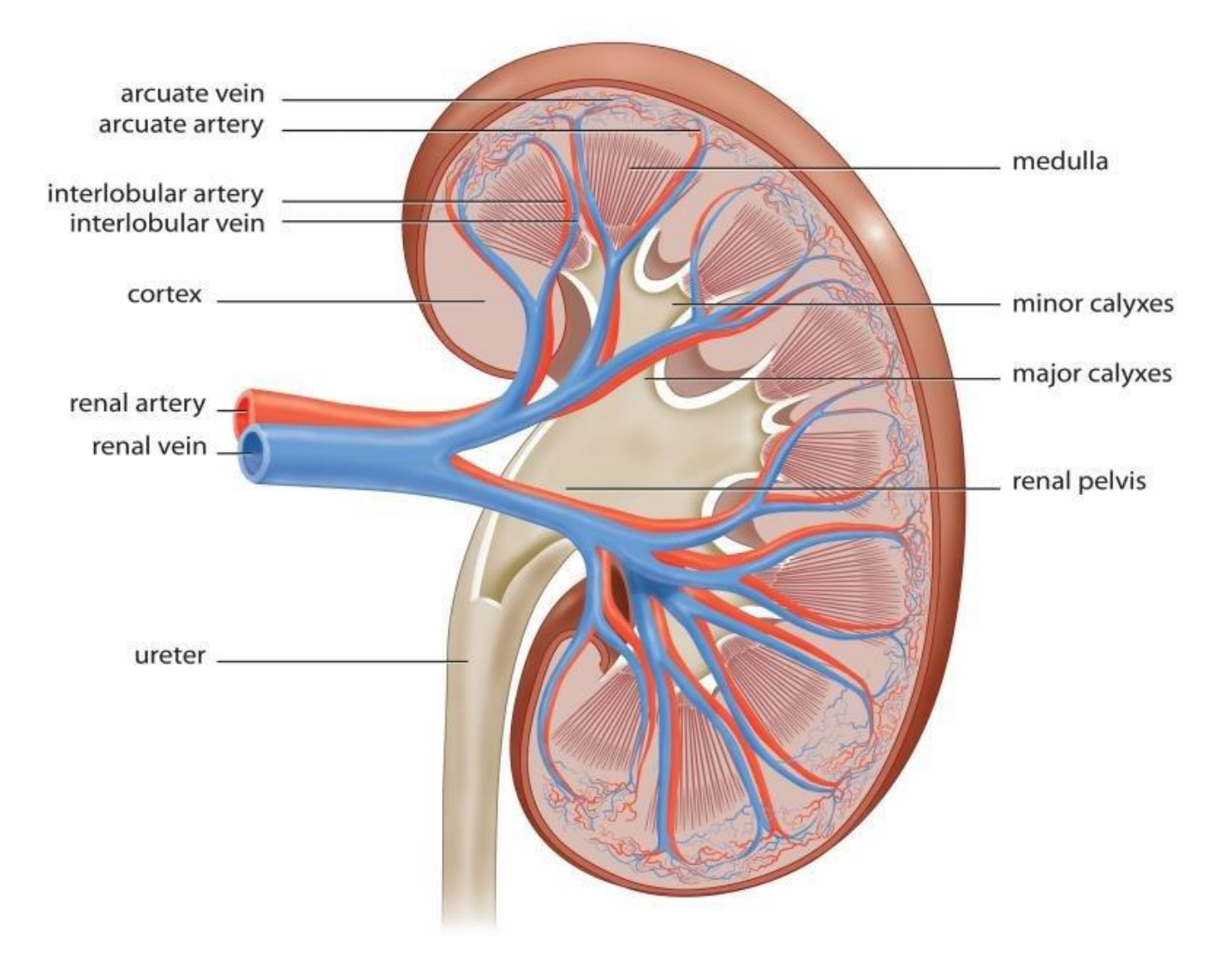
- Normal ranges
- Introduction of kidney
- Renal function test
- Urine examination
- Blood analysis
- Tubular function test
- Glomerular function test
- Kidney disease based on GFR value
- Renal function test applied on

THE NORMAL VALUES/REFERENCE RANGE IS MENTIONED USED IN RFT :

- **Serum Urea** (15-45 mg/dl)
- **Serum Creatinine** (0.6 – 1.2 mg/dl)
- **Serum Uric acid** (males 3.5-7.2 mg/dl, females 2.6-6 mg/dl)
- **Total protein** (6.4-8.1 g/dl)
- **Serum albumin** (3.2-4.6 g/dl)
- **Serum electrolytes** • **Na** (136-146 mEq/L) • **K** (3.5-5.1 mEq/L) • **Cl** (101-109 mEq/L) • **Phosphate** (2.8-4 mg/dl) • **Calcium** (8.8-10.2 mg/dl)

INTRODUCTION OF KIDNEY

- kidney is a major organ
- kidney job is to filter blood
- functional unit of kidney is nephron



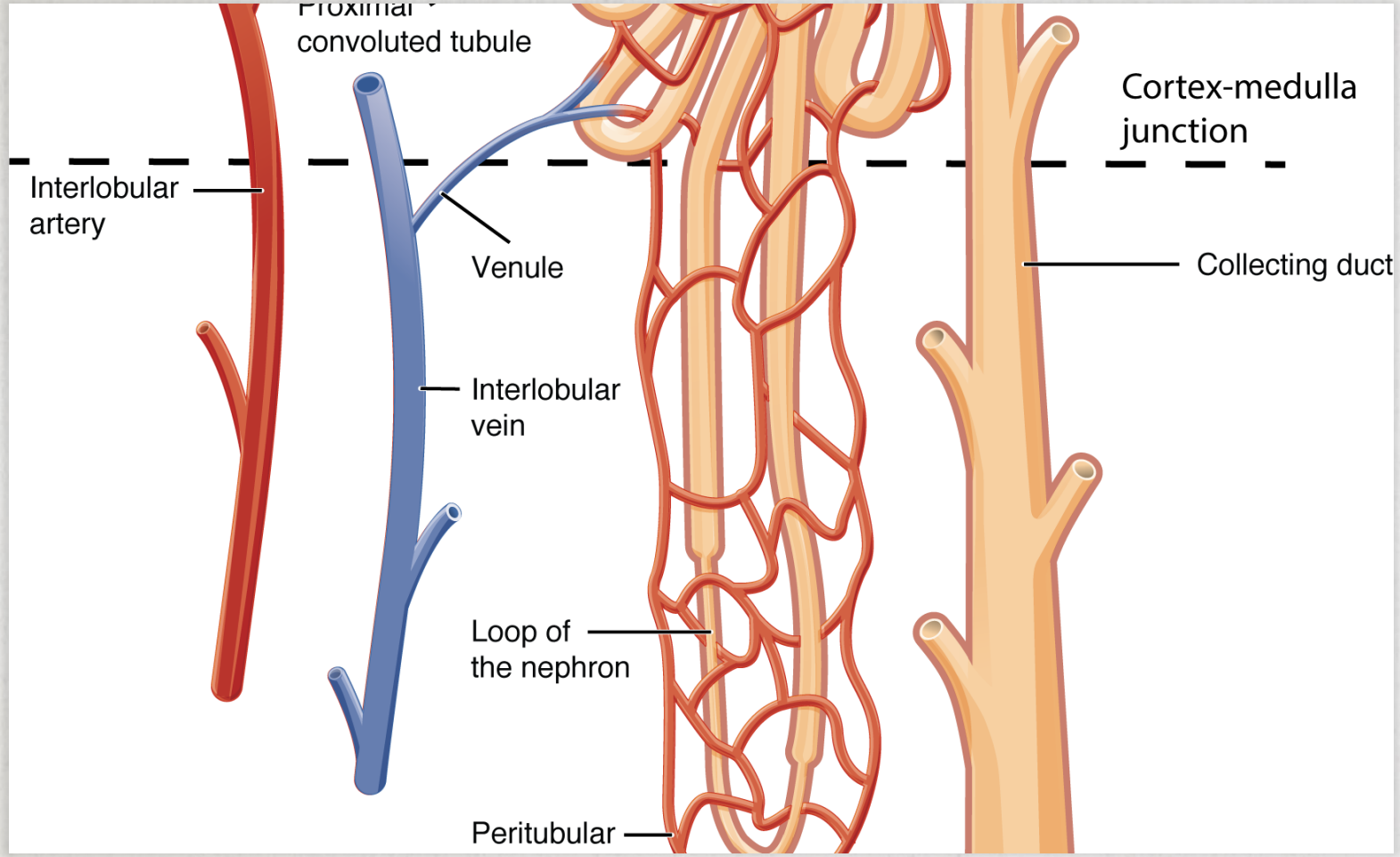
HUMAN KIDNEY

diagram

FUNCTION OF KIDNEY

the major function of kidney are -

- **regulation of extracellular fluid -** the kidney work to ensure adequate quantity of plasma to keep blood flowing to vital organs.
- **Regulation of Ion concentration**
- **regulation of pH**
- **excretion of waste and toxin**
- **production of hormones - Renin, erythropoietin**
- **retention of substance**



NEPHRON

Blood flow in nephron

RENAL FUNCTION TESTS; WHY NEEDED?

- To assess functional capacity of kidneys
- To diagnose renal impairment
- To assess the severity and progression of renal impairment
- To assess the effectiveness of treatment

Causes of renal disease :

 # Pre-renal

Any condition that results in reduced blood flow to kidneys

1 Severe blood loss

2 Hemolysis

 # Renal

Damage to renal tissue, glomerular basement membrane or tubules

1 Glomerulonephritis

2 Diabetic or hypertensive nephropathy

3 Tubular damage due to toxic substances

 # Post Renal

Obstruction to urine outflow

1 Ureteric or urethral stone

2 Prostatic cancer

RENAL/ KIDNEY FUNCTION TEST

KFT is based on 4 groups

- **Urine examination**
- **Blood analysis**
- **Tubular function test**
- **Glomerular function test**

URINE EXAMINATION

- Based on 4 types

1) **physical examination**
2) **chemical examination**
3) **microscopical**
4) **Bacteriology**

Physical examination :

- examine the last 24 hours patient urine and Examin substance are –
- Urine appearance
- volume (800-2000ml)
- pH 6.8
- colour (straw colour)
- Odour
- specific gravity (1.020)

Chemical Examination : Mid stream urine is collected for examine and the test applied in chemical examination are –

- Test for protein - **heat coagulation**
- test for sugar - **Benedict test, fehling test**
- test for Ketone body - **rother's test, gricard's test**
- test for blood - **Ortho tolidrine test**
- bile salt/bile pigment - **Hay's sulphur test, Fouchet t**est

Microscopic examination :

- Detection of RBC, WBC and epithelial cell is present or seen in a normal patient
- it means patient have urinary tract infection UTI or KFT

Bacteriology : Identification of bacteria

BLOOD ANALYSIS / BLOOD BIOCHEMISTRY

Blood analysis diagnos Urea albumin, blood urea nitrogen (BUN) and creatinine, electrolytes

- **Creatinine** - normal range = 0.7 - 1.34 mg/dl

Creatinine value increase in glomeular nephritis, nephrotic syndrome, tuberculosis, stone

- **Urea and BUN** - normal range of Urea = 15 -40 mg/dl range of blood urea nitrogen = 5 - 20 mg/dl kidney disorder increase urea and BUN level

- **Albumin** - normal range of albumin = 3 - 5 gm nephrotic syndrome acute, glomerular nephritis decrease albumin level

- **Electrolytes** - Normal range of sodium = 135 - 150 mmol/liter
  Normal range of potassium = 3.5 - 5 mmol/liter
  Normal range of calcium = 9 -11 mg%

TUBULAR FUNCTION TEST

- Two test are done –

1) **URINE CONCENTRATION TEST**
2) **URINE ACIDIFICATION TEST**

- URINE CONCENTRATION TEST- Measurement of specific gravity of urine

  1.020 is the specific gravity of urine in morning

two types of test are applied in urine concentration test

1) **water derivation test** : procedure

- overnight fasting of 14 to 16 hours
- artificial meal is provide before 1 hour from fasting
- 3 samples collected at interval of 1 hours

result :

- if patient is normal then out of three samples one have value 1.020
- if value is same, less or more in all three samples it means patient is abnormal

2) Antidiuretic hormone test (ADH) :

- Firstly meal is given to patient after 1 hour vasopressin peptide hormones (ADH) is injected in patient body
- then overnight fasting (no water is given)
- in morning to sample are collected in one hour interval
- Now specific gravity is measured

result :

- in normal patient out of two sample one have value of 1.020
- if value is same in both sample it mean patient is abnormal

- **Note** - this test is not performed in HYPERTENSION and DIABETIC PATIENT

GLOMERULAR FUNCTION TEST

Clearance test

- **inulin clearance test**
- **creatinine clearance test**
- **urea clearance test**

Renal clearance - volume of Plasma that would be completely cleared a substance per minute

Glomerular filtration rate (GFR) = 120 -125 ml/minutes

INULINE CLEARANCE TEST :

- Neither reabsorbed nor secreted by renal tubules
- inulin clearance value is equal to GFR
- inulin enter in kidney through Blood

Procedure for inulin creatinine test

- light breakfast is given in morning
- then100ml inulin is injected to patient body in 10 ml dose in every 1 minute
- after 1 hour first urine is discard but blood sample is taken
- after one hour interval first urine sample is collected and half hour interval second blood sample is collected
- second sample of urine is collected after 1 hour

RESULT :

- U = concentration of inulin in urine in mg/dl
- V = volume(ml) of urine
- P = concentration of inulin in plasma in mg/dl

- Inulin clearance = 125ml i,e GFR = 125ml

CREATININE CLEARANCE TEST :

- creatinine is muscle waste product
- approximately 2% of the body creatine is converted to creatinine
- more muscle in person has produce more creatinine

- Normal range of serum creatinine = 0.7 - 1.5 mg/dl
- Normal range of creatinine clearance in urine = 120 -140 mg/dl
- is based on two methods

traditional method
modified method

 # Traditional method - Procedure :

- collection of 24 hours urine specimen
- blood specimen is collected for serum creatinine estimation at the midpoint of 24 hours urine collection
- the concentration of creatinine in both serum and urine is measured
- total urine volume is measured carefully
- creatinin clearance is calculated

Modified method Procedure :

- Water is given to patient in normal quantity
- Then urine is collected after 1 hours
- Blood sample is also collected
- Now creatinine clearance is measure

- creatinine clearance formula = $\frac{UV}{P}$

UREA CLEARANCE TEST

- urea is end product of protein metabolism
- This test is based on urine output
- measures the amount of **urea** in your urine

procedure for urine clearance test :

- light breakfast is given to a patient
- then 2-3 glass of water is given (water is not more than 600ml)
- send patient for urine discard
- after one hour urine sample is collected and blood sample also collected
- second urine sample and blood sample is collected after 1 hour interval
- now examine the following things in urine and blood sample –

 # Urine concentration

 # Urine volume

 # Blood concentration in urine

 # Output of urine

Result :

- if urea clearance is less than 70% renal function is normal
- if urea clearance is between 40 to 70% renal function is mildly impaired
- if urea clearance is less than 20% renal function is severely impaired

KIDNEY DISEASE BASED ON GFR VALUE

- Normal kidney function - less than 90
- Mildly reduced - 60 – 89
- Moderately reduced - 30 – 59
- Severly reduced - 15 – 29
- End stage renal failure - less than 15

RENAL FUNCTION TEST APPLIED ON

- Who have chronic kidney disease in family history
- patient differ from hypertension
- patient with autoimmune disease
- urinary tract infection
- drug toxicity

THANKU YOU