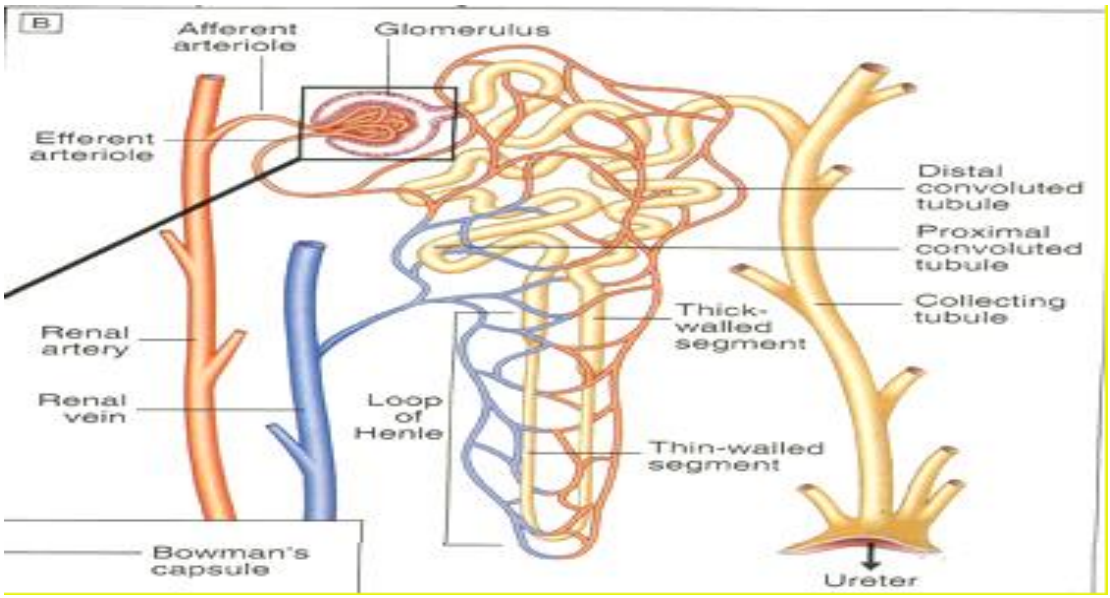


NEPHROLOGY

- Glomerular diseases:
  1) Nephritic:
     a) AGN- PSGN, IgA/HSP,SLE
     b) RPGN- ANCA, Ag/Ab complex mediated, anti GBM
     c) Hereditary nephritis- Alport's & TBMD
  2) Nephrotic:
     a) Primary: MGN, FSGS, MCD, MPGN
     b) Secondary: D/M, HIV-AN, Amyloidosis, SLE
- Tubular diseases
  1) Cystic diseases:
     a) ADPCKD/ARPCKD
     b) NEPHRONOPHTHESIS/MCKD
     c) MSK
  2) RTA
  3) Liddle's syndrome, Gittelman syndrome, Barter syndrome, PHA type 1 & 2
- Vascular diseases
  1) RAS
  2) RVT
  3) HUS/TTP
- Interstitial (tubulo-interstitial nephritis)/pyelonephritis
  1) Acute
  2) Chronic
- ARF/AKI (pre-renal, renal and post renal)
- CRF/CKD (D/M, CGN, HTN, ADPCKD, CIN/CPN)

CKD STAGES

Stage	Description	GFR, mL/min per 1.73 m^2
1	Kidney damage with normal or increased GFR	> 90 (Abn U-RM / USG)

2	Kidney damage with mildly decreased GFR	60 – 89
3	Moderately decreased GFR	30 – 59
4	Severely decreased GFR	15 – 29
5	Renal failure	< 15 (or dialysis)

Pathogenesis: the 2 mechanisms of progressiveness of CKD.
Urine output/symptoms/urine analysis/KFT/USG findings in various stages.

CLINICAL FEATURES OF UREMIA

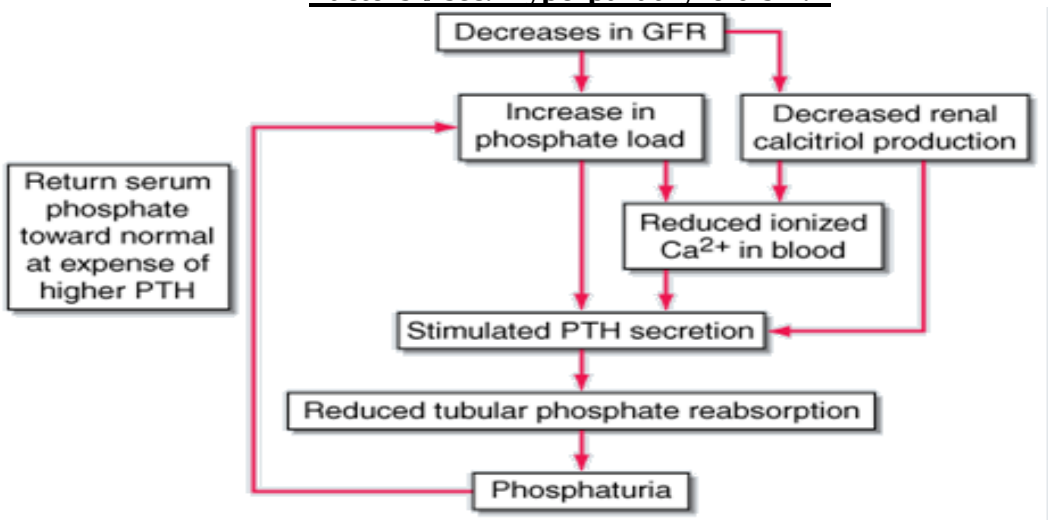
1) Fluid and electrolyte disturbances

- Volume expansion (I)
- Hyponatremia (I)
- Hyperkalemia (I)
- Hypermagnesemia (I)
- Hypocalcemia (I)
- Hyperphosphatemia (I)
- Metabolic acidosis (I)

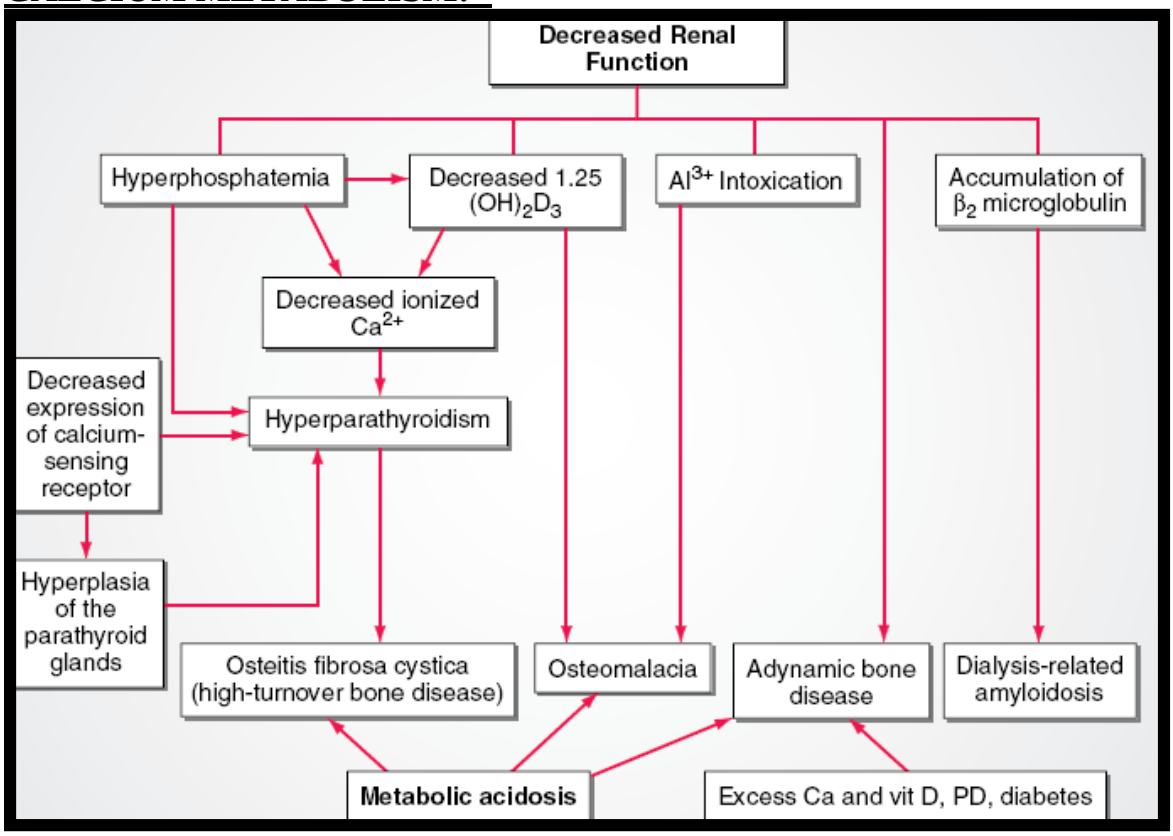
2) Endocrine-metabolic disturbances

- Secondary hyperparathyroidism (P)
- ABD (PD)
- Osteomalacia (I)
- Hyperuricemia (I)
- Hypertriglyceridemia (P)
- Increased Lp(a) level (P)
- Decreased high-density lipoprotein level (P)
- Infertility and sexual dysfunction (P)
- Amenorrhea (P)
- beta 2-Microglobulin deposition (P)
- Associated amyloidosis (P)

Factors→sec. Hyperparathyroidism: -



CALCIUM METABOLISM: -



3) Neuromuscular disturbances

- Impaired consciousness (I)
- Asterixis (I)
- Myoclonus (I)
- Seizures (I)
- Coma (I)
- Peripheral neuropathy (I)
- Paralysis (I)
- Restless legs syndrome (I)
- Muscle cramps (P or D)
- Myopathy (P or D)

4) Cardiovascular and pulmonary disturbances

- Arterial hypertension (I) (MC)
- Pulmonary edema (CHF, fluid overload, Uremic lung) (I)
- Pericarditis (I)
- Accelerated atherosclerosis (P)
- Vascular calcification (P)

CKD → HTN:

- All the diseases causing CKD, even TID → HTN during later stages.
- MC cause of secondary HTN

- Mech. Fluid overload, ↑ rennin & EPO
- Prazosin, clonidine, metoprolol, amlodipine & ACE/ARB.

5) Dermatologic disturbances

- Pallor (I)
- *Sallow colour(I)*
- Hyperpigmentation (I)
- Pruritus (P)
- Uremic frost (I)

6) Gastrointestinal disturbances

- Anorexia (I)
- Nausea and vomiting (I)
- Uremic fetor (I)
- Gastroenteritis (I)
- Peptic ulcer(I)
- Gastrointestinal bleeding (I)

7) Hematologic and immunologic disturbances

- Anemia (I)
- Bleeding diathesis (I)
- Increased susceptibility to infection (I)

Treatment

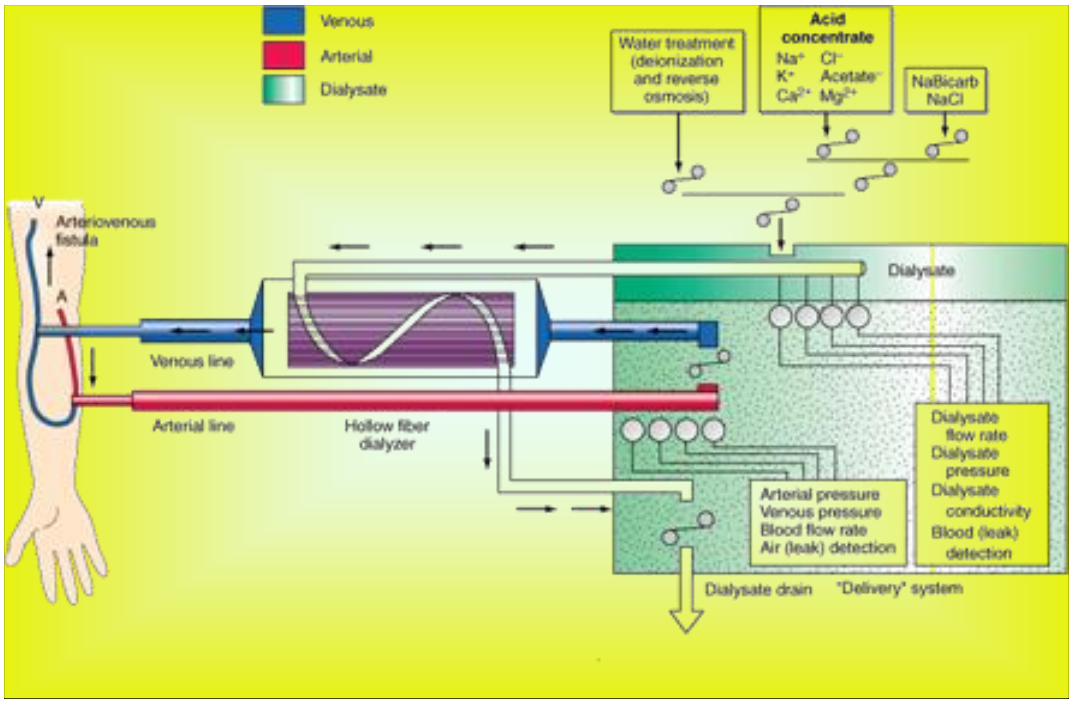
Renal replacement therapy (ESRD GFR < 15 ml/min)

1. Maintenance Hemodialysis (HD)
2. Continuous ambulatory peritoneal dialysis (CAPD)
3. Renal transplantation

INDICATIONS OF DIALYSIS IN CKD PATIENTS:

i) Uremic encephalopathy
ii) Peripheral neuropathy
iii) Uremic pericarditis
iv) Uremic lung
v) Bleeding
vi) Severe/dangerous and persistent/refractory hyperkalemia

HEMODIALYSIS TECHNIQUE:



- **Complications of Hemodialysis:**
- **Acute:** hypotention (MC), hypoglycemia, anaphylactoid reactions, muscle cramps, bleeding, CHF
- **Chronic:** aluminium related- dialysis dementia, ABD, osteomalacia
  Amyloidosis
  HIV, Hep B, Hep C

UREMIC MANIFESTATIONS WHICH REMAIN PROGRESSIVE DESPITE HD:

1) ***Secondary hyperparathyroidism***
2) ***Atherosclerosis***
3) ***Sexual dysfunction***
4) ***Amyloidosis***
5) ***Myopathy***
6) ***Pruritus***

HEMODIALYSIS: Li, Barbiturates, Salicylates, Methanol/EG
HEMOFILTERATION: Radiocontrast agents
HEMOPERFUSION (Molecular Adsorption Re-circulating System): Phenytoin, TCA, Phenothiazines

CAPD/CCPD indications same as H/D(except poisoning/drug intoxications and ARF)
Complications:

1) **Peritonitis**
2) **Right sided pleural effusion**
3) **Hypoalbuminemia**
4) **Hypercholesterolemia**
5) **Hyperglycemia**
6) **ABD**
7) **HTN**

1.Diabetic Nephropathy

- MC cause of ESRD Worldwide - approx. 45% of patients receiving RRT.

- Risk of nephropathy:Type 1 Vs Type 2 diabetes?

Pathophysiology or stages in the development of diabetic nephropathy:

I. Stage of Hyper Filteration :

- Within 1-2 years of onset of Type 1 DM

II. *Stage of Glomerulo - sclerosis* :

- 2-5 years of onset of Type 1 D/M
- ***Thickening of GBM***
- ***diffuse Glomerulo-sclerosis***
- **Kimmelstiel-Wilson (KW) nodules**.
- Intercapillary glomerulosclerosis
- "***Capsular drop ".***
- Diabetic exudates or hyaline caps or fibrin caps.
- Podocyte effacement

III. Stage of Incipient Nephropathy :

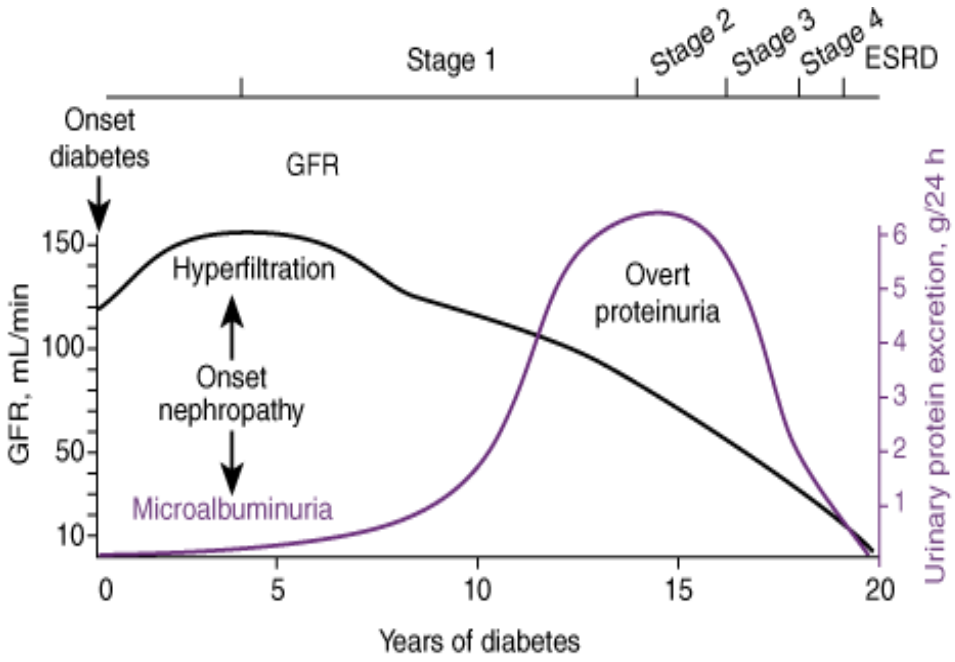
- Stage of microalbuminuria- after 5 years of onset of Type 1 DM

IV.Stage of Overt Nephropathy :

- After 5-10 years of uncontrolled microalbuminuria

V.Stage of ESRD :

- Approx 20 years after onset of Type 1 D/M.



Diagnosis of Diabetic nephropathy:

i. USG

ii. fundus examination ***(90% of Type 1 DM & 60% of Type 2 DM develop retinopathy first and then later on nephropathy)***
iii. Significant proteinuria till late in CKD

Other renal presentations/complications
i. Nephrotic Syndrome
ii. Renal papillary necrosis
iii. Type 4 RTA
iv. Increased predisposition to pyelonephritis
v. Increased risk of contrast nephropathy

Treatment:
Preventive Strategies:
i. Tight glycemic control
ii. BP control
iii. Periodic screening for microalbuminuria which once established – treatment with ACE/ARB, even if the person is normotensive.

Acarbose is the safest OHA.
Hypoglycemic agent of choice?
Insulin dose modification?
1.CGN → Prognosis
2.HTN → CKD:

Malignant HTN:
Necrotising arteriolitis
Hyperplastic arteriolitis (onion skin lesions)
Flea bitten kidney

Microangiopathy → ARF

Benign HTN:
Hyaline arteriolosclerosis
1. ADPCKD
2. CIN/CPN

Transplantation in the treatment of renal failure:
- Most effective treatment

Recipient Factors:-
1. Should be ABO (absolute) and HLA class I (A, B) and class II (DR) antigens (relative) compatible. Rh system is not necessary.
2. ESRD
3. Relatively non invasive, iliac fossa

Donor Selection:
Living related or un-related or cadaver

IMMUNO-SUPPRESSIVE DRUGS

IDENTICAL TWINS VS SIBLINGS WITH FULLY MATCHED H L A

1. Glucocorticoids
- Prednisone
- Binds cytosolic receptors-Blocks transcription of IL-1,-2,-3,-6, TNF,IFN

- **SE**-Hypertension, glucose intolerance, PUD, Dyslipidemia, osteoporosis cat, glaucoma steroid induced psychosis, Cushing's hypokalemia etc.

2. Cyclosporine (CsA) complex with calcineurin -blocking IL-2 production.
SE- Nephrotoxicity, hyperkalemia, hypertension, dyslipidemia, glucose intolerance, hirsutism, hyperplasia of gums. No bone marrow suppression.

3. Tacrolimlus (FK506) (more potent but more toxic than cyclosporine, additionally neurotoxic)
Macrolide,MOA & SE similar to CsA.

4. Azathioprine Mercaptopurine analogue,inhibit purine synthesis,Marrow suppression

5. Mycophenolatemofetil (MMF)
Inhibits purine synthesis via IMP, marrow suppression is relatively less.

A typical immuno suppressive regimen in low risk patients.
Cyclosporine + azathriprine + steroid

Complications following transplantation:
Rejection
Infections
Malignancies
Recurrence of primary disease

1. **All diseases recur except genetically mediated diseases eg. Alports & PCKD**
2. **MPGN** (Earliest & MC recurrence causing graft failure)
3. **De-novo GN** -5% of patients of **Alport's syndrome** develop **anti GBM disease** in the transplant.

Causes of Acute Renal Failure (ARF)
PRERENAL ARF
1.Hypovolemia (MC):

a) **Diarrhea**
b) **Severe burns**
c) **Hemorrhage**
d) **Acute pancreatitis**
e) **Severe hypercalcemia**

2.Low cardiac output:

a) **CHF**

3.Altered renal systemic vascular resistance ratio:

a. **Septicemia**
b. **Anaphylaxis**
c. **Hepato-renal syndrome**

HRS: renal failure in patients with severe liver disease in the absence of any renal pathology. These failing kidneys can be successfully transplanted. After liver transplantation kidney function returns to normal

4.Renal hypo perfusion with impairment of renal auto regulatory responses:

a. **NSAID'S**
b. **ACE inhibitors/ARBs**

INTRINSIC RENAL ARF

I.Reno vascular obstruction (bilateral or unilateral in the setting of one functioning kidney):

a) **RAS**
b) **RVT**

Renal artery stenosis

- Causes: atherosclerosis (MC-85% pts), FM dys., Takayasu's arteritis/TB (non sp. Aorto arteritis) (15% patients young)
- Clinical implications: HTN, IN,ARF with ACE/ARB
- When to suspect: sec. HTN (<30 or >50)
  - HTN emergency
  - Atherosclerotic complications
  - Hypokalemia (MC) / hyperkalemia
  - Refractory HTN
- Diagnosis: USG-Doppler, MRA/DSA, Arteriography , Captopril renography with Tc (Tc MAG_3 Captopril enhanced plasma Renin assay
- Treatment: Conservative approach in atherosclerotic RAS

Indications of PTA in atherosclerotic RAS-uncontrolled BP despite t/t, progressive rise in Cr.
FM dys - PTA

RVT:

Causes: Virchow's triad

a) Hypercoagulable states: NS, factor V leiden, OCPs, pregnancy, disseminated malignancy, hyperhomocystenemia, SLE with APLA, obesity, steroids in the t/t of NS
b) Stasis: retroperitoneal fibrosis, RCC, dehydration (diarrhea, diuretics)
c) Endothelial damage: trauma

Diagnosis: USG-Doppler, MRA/CT-veno, venography
Treatment : anticoagulants, thrombolysis

II.Diseases of renal microvasculature

a. **HUS/TTP/DIC**
b. **Hypertensive emergency**
c. SLE with APLA
d. Scleroderma renal crisis
e. Eclampsia
f. Radiation Nephritis

III.Diseases of glomeruli

a. AGN
b. RPGN

IV.Acute tubular necrosis (90% of cases)

a. Ischemia:
b. Toxins (aminoglycosides, AmB, Cisplatin, PCM,Cyclosporine, radiocontrasts, EG, Hb, Mb, BJP

Causes of Rhabdomyolysis
Crush injury, burns, electric shock injury
Convulsions, drugs (**amphetamine/cocaine/heroin)**
Infection
Hyperthermia
Hypokalemia, hypophosphatemia, hypothyroidism
Fibrates, HMG CoA reductase inhibitors
Hornet stings

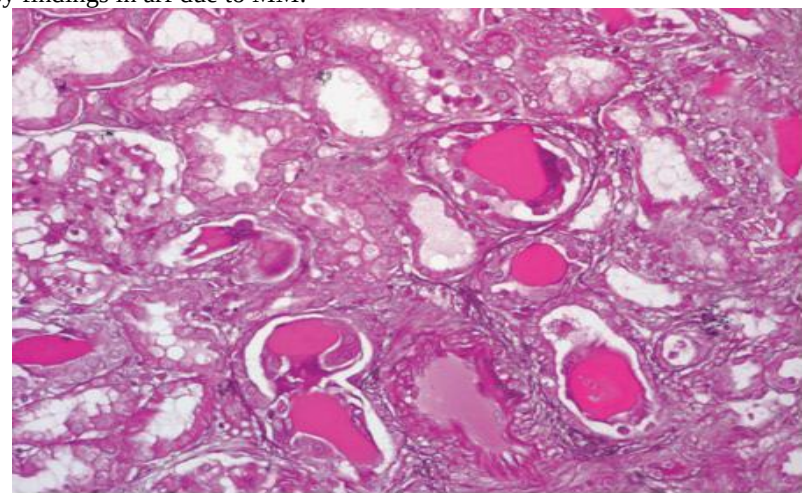
Hemoglobinuria causes

- Mismatched blood transfusion
- G-6PD def.
- Autoimmune hemolytic anemia
- Malaria
- Cu SO4
- Snake byte

V.Intra-tubular obstruction

a. Endogenous: (uric acid, BJP)
b. Exogenous: (acyclovir, ganciclovir, foscarnet, indinavir, MTX)

Kidney Biopsy findings in arf due to MM:



VI.Acute Interstitial Nephritis:

a. **Allergic (antibiotics (beta-lactum methicillin), R cin, ethambutol, diuretics, NSAIDs, Allopurinol)**
b. **B/L pyelonephritis (leptospirosis)**

POSTRENAL ARF (OBSTRUCTION)

I. Ureteric

B/L Calculi, blood clot, sloughed papillae, cancer, (Ca Cx stage?)

II. Bladder neck

Prostatic hypertrophy (MC), neurogenic bladder (overflow incontinence),Ca. bladder

III. Urethra

Stricture, congenital valve, phimosis

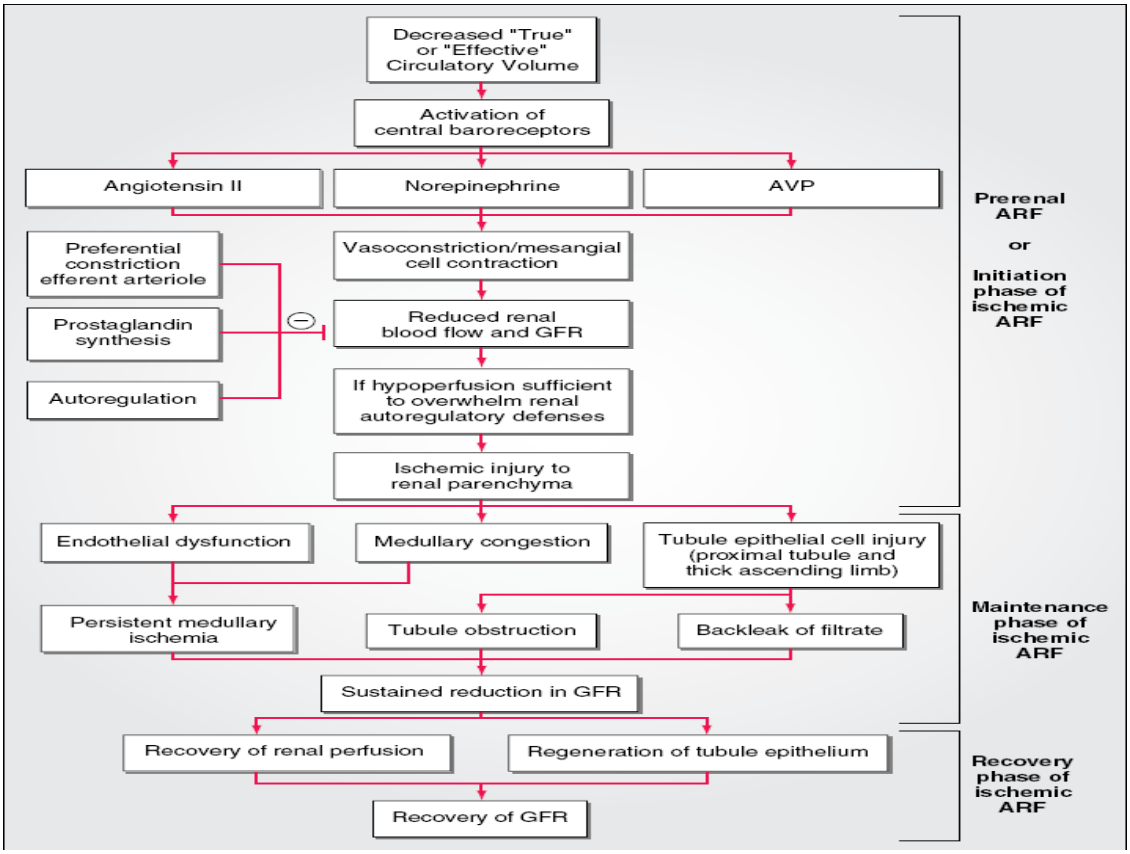
RENAL PAPILLARY NECROSIS; causes:-

- D/M (MC)
- Analgesic abuse
- U T obstruction
- Recurrent pyelonephritis
- Alcoholism
- Sickel cell disease

- TB
- RVT

- GN & ATN have not been found to be associated with renal papillary necrosis.

ATHOPHYSIOLOGY OF AKI: -



	Typical findings in ARF	
Diagnostic Index	Pre renal	Acute tubular necrosis/Acute interstitial nephritis
Fractional excretion of sodium (%) FeNa Most Sensitive test $\frac{U_{Na} \times P_{Cr}}{P_{Na} \times U_{Cr}} \times 100$	< 1	> 1
Urine sodium concentration (mmol/L)	< 10 or < 20	> 20 or often even > 40
Urine specific gravity	> 1.020	~ 1.010
Urine osmolality (mosmol/kg H_2O	> 500	~ 300
Plasma BUN/ creatinine ratio	> 20 :1	< 10 – 15 :1
Urinary sediment	Hyaline casts No proteinuria/hematuria	Muddy brown granular casts/renal tubule epithelial casts/WB casts Proteinuria + / hematuria +

Urine creatinine to plasma creatinine ratio	>40	<20
Urine urea nitrogen to plasma urea nitrogen ratio	>8	< 3

Acute	**Vs**	**Chronic**
1. Recent ↓ GFR		Azotemia > 3 mts.
2. Oliguria→ Polyuria		Polyuria / Nocturia→ oliguria
3. hypotension		HTN
4. Also present		NCNC anemia, hypocalcaemia, hyperphosphatemia etc
5. --		Renal osteodystrophy
6. Pigmented muddy br. granular casts		Broad waxy casts
6. USG normal/↑ size		↓↓ → CGN, HTN, CPN/CIN, RAS→IN, Nephronophthisis except infantile variety/ MCKD **N to**↑-D/M, HIV-AN (collapsing nephropathy), Amyloidosis ↑↑↑↑- AD/AR-PCKD, infantile nephronophthisis HDN

Abnormalities of U-R, M –

Proteinuria: upto 150mg/d, <30mg-albumin (200 mg/hr fil.)

The other important small molecular wt. plasma proteins, besides albumin, which are filtered down are:

1) α_1-microglobulin
2) β-globulins such as β_2-microglobulin
3) Retinol binding protein (RBP)
4) Hormones ex. Insulin (50% of insulin catabolism occurs in the kidneys)

Causes:

i) Glomerular: Nephritic & Nephrotic syn. (Most extensive) (+++ / ++++)
ii) Tubular: Small mw., upto 1 gm/d least extensive (+)
iii) Vascular: Variable (++)
iv) Overload: MM, rhabdomyolysis, hemoglobinuria
v) Functional (orthostatic) = 500 mg/d, early morning 1st urine sample while patient is recumbent shows no proteinuria, no treatment

T/t – ACE / ARBs

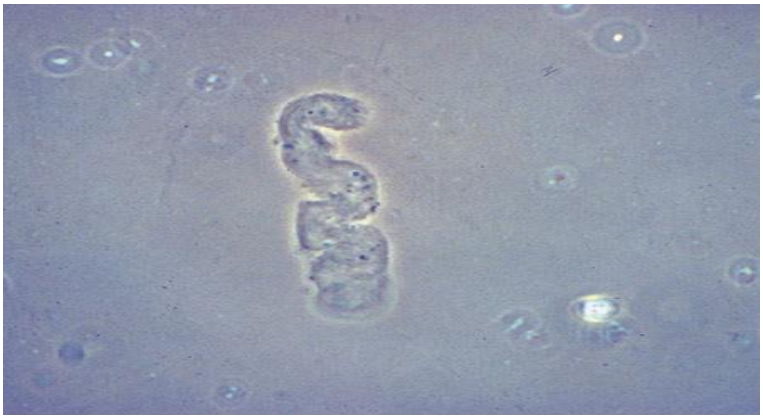
Dipstic- detects Alb. (-ve charge) **(what about Bence Jones pr.)**

Microalbuminuria	**Macroalbuminuria**

1) 30-300 mg/day or	>300mg/day or
30-300mg/gm Cr. (emsu)	>300mg/gm Cr. or
20-200mg/L	>200mg/L
2) Immunometric	routine dipstick
MICRAL test.	
3) Risk for Nephropathy	
(Reversible)	Marker of progression (irreversible)
4) CV risk	increased CV risk

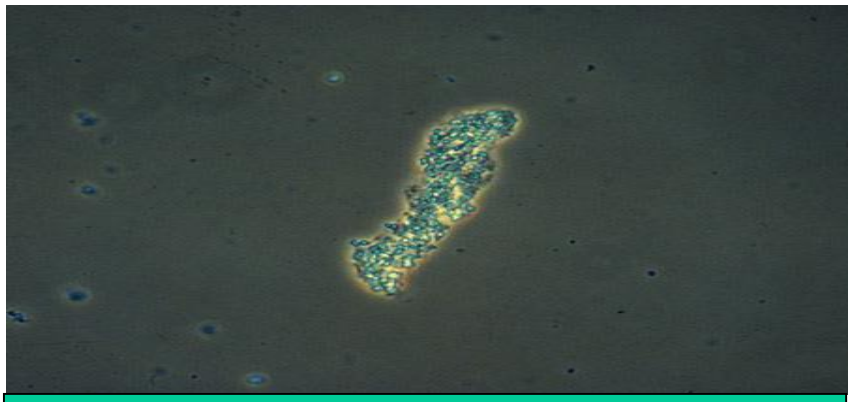
Hematuria: def: 2-5 RBCs/HPF (dipstick + in myoglobinuria & hemoglobinuria as well).
Causes: 90%-Urological cause (isolated& gross), 10% Kidney (other abnormal & microscopic)
Urological: UTI (MC), stone, papillary- necrosis, parasitic, malignancy.
Glomerular: glomerulonephritis, nephrotic diseases (approx 20% cases).
Interstitial: PCKD,MSK, TB, Pyelonephritis, rejection, hypercalcemic, hyperurecemic nephropathy etc
Vascular: coagulopathies, excessive anti-coagulation (MC-site of bleeding in heparin overdose-hematuria, renal arterial thrombosis, renal vein thrombosis, HUS/TTP

Casts : (Tamm Horsfall pr.)
Types:
i) Hyaline (MC) –Conc. urine, fever exercise, CHF (other pre renal conditions) (not s/o disease) normal Cast
ii) Red cell casts – AGN/ RPGN
iii) WBC casts- pyelonephritis and interstitial nephritis, AGN **/ RPGN**
iv) Granular-s/o damaged casts, pathological (non -sp.) Cast
v) Renal tubule epithelial cell casts- ATN
vi) Broad waxy casts- CRF **(Late): Most dangerous, truly pathognomonic**
vii) Fatty casts- nephrotic syndrome.

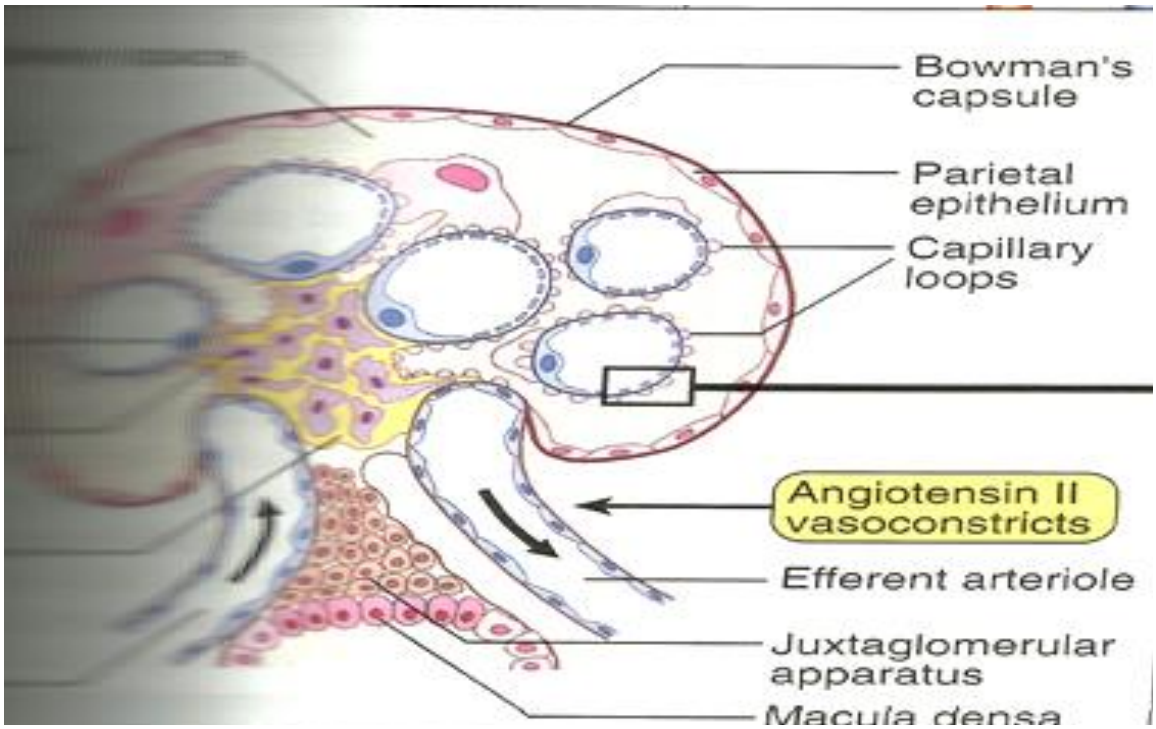


HYALINE CAST

RBC-CAST



GRANULAR CAST


Bowman's capsule
Parietal epithelium
Capillary loops
Angiotensin II vasoconstricts
Efferent arteriole
Juxtaglomerular apparatus
Macula densa

Acute (Post infections glomerulonephritis)	Gp.A beta-hemolytic streptococci and others	Focal or diffuse proliferative glomerulonephritis	IgG, IgM & C3 deposition granular pattern	Subentholial as well as subepithelial deposits or humps	Trapped Immune complexes
IgA nephropathy & HSP	Associated with upper respiratory tract infections & gastrointestinal infection	Mesangio-proliferative glomerulonephritis	***Mesangial deposition of IgA (often with C3 IgG, IgM) (Diagnostic***)	Mesangial deposits	the O-galactosylation of the hinge region of IgA
RPGN	(i) Panci-immune (MC in adults)	Cresentic glomerulonephritis	No Immunoglobulins	No deposits	Role of ANCAs & Cell mediated immunity
	(ii) Immune	Cresentic glomerulonephr	Granular pattern IgG,	Deposits in subepithelium,	Trapped immune

	complex (MC in children)	itis	IgM, C3	subendothelium & mesangium	complexes
	(iii)ANTI-GBM DISEASE	Cresentic glomerulonephritis	IgG, C3 ***(linear pattern)***	Widening of GBM (deposits along the basementmembrane)	Auto antibodies IgG against (α3/ α4 ch. type iv)

Nephrotic Syn.:-

- Proteinuria >3.5gm/1.73m2/day (selective vs. non)
- Hypoalbuminemia (<3gm/dl) (Pan Hypoproteinemia except?)
- Consequences of loss of other pr.ex.Ig, pr. C, S&AT-iii, carrier pr.for trace metals, Transferrin, cholecalcipherol binding pr., TBG, altered pharmacokinetics of highly pr bound drugs.
- Hyperlipidemia (early acc. Atherosclerosis)
- Lipiduria (Fatty casts)
- Anasarca (most imp pathophysiologic mech.?) (1° salt & ↑ 2° water retention)
    - Azotemia occurs late with onset of CRF (toxicity due to proteinuria), subsequent uremia & complications (mild hematuria & HTN early on in some adult nephrotic syn.
    - Imp. causes of adult NS: **MGN**, FSGS, MCD, MPGN, D/M, Amyloidosis, HIV-AN, SLE

DISEASE	ETIOLOGY	(LM)	(IF)	(EM)	PATHO-GENESIS
MCD	(i)Idiopathic (MC) (ii) viral infections(HIV) (iii)Hodgkin's disease (iv)other lymphomas & leukemias (v) allergy (vi) NSAIDS (vii) Interferon	no change	No Immunoglob. or complement	Fusion/effacement of foot processes	loss of GBM polyanions
MGN	Idiopathic (MC 85% patients) Infections: hepatitis B, syphilis, filariasis Carcinoma Breast, lung and colon Drugs: Penicillamine NSAIDS, Gold Auto-immune: SLE, RA	Thickening of GBM	(Granular IgG & C3) deposition	Dense deposits in GBM subepithelial	In-situ Immune Complex Deposition

FSGS	HIV (collapsing variant) Reflux nephropathy Heroin abuse Morbid obesity secondary to any pathology	Focal segmental sclerosis	IgM & C3 in sclerotic segments		
MPGN Type 1	HepatitisC ± Cryoglobulin. Quartan malaria(P.mal)	↑ mesangial cells and matrix ***splitting of GBM or doubling of GBM Tram-Track appearance***	Granular C3 and C4 with IgG & IgM	mesangial interposition into an expanded GBM → Mesangio-capillary GN	Unknown
Type 2	(i) Partial lipodystrophy	(same as Type 1) (Tram Track appearance).	C3 only	Dense deposit disease.	Unknown

HIV

- HIV can present with any kidney pathology
- The clinical features of HIVAN being nephrotic range proteinuria and a fast progression (within 1-2 years to ESRD).
- Unique feature
- Treatment

LUPUS NEPHRITIS

Class 1	Minimal Mesangial	Normal histology on LM. IF & EM may show mesangial deposits	Normal renal function	No treatment required, excellent prognosis
Class II	Mesangial proliferation	Mesangial hypercellularity with mesagial immune deposits	Normal renal function	No treatment required, excellent prognosis
Class III	Focal Nephritis	Focal endocapillary ± extracapillary proliferation with focal subendothelial immune deposits.	Nephritic presentation	Steroids alone (<5% go to ESRD)
Class IV	Diffuse nephritis	Diffuse endocapillary ± extracapillary proliferation with diffuse subendothelial immune deposits. Wire loop lesions are characteristic	More severe nephritic presentation	Steroids + Cyclophosphamide Or MMF. majority go to ESRD if untreated

Class V	MGN	Thickenend basement membranes with diffuse subepithelial immune deposits	Nephrotic syndrome	ACE inhibitors Steroids + Cyclophosphamide Or MMF.
Class VI	Sclerotic nephritis	Sclerotic glomeruli with interstitial fibrosis	ESRD	HD or PD or transplantation

- BIOCHEMICAL AND CLINICAL CHARACTERISTICS OF THE VARIOUS TYPES OF RENAL TUBULAR ACIDOSIS

	Type 1 RTA	**Type 2 RTA**	**Type 4 RTA**
Etiology	Hereditary Drugs; Lithium, AmB MM	Acetazolamide Hereditary Fanconi Syndrome (Heavy Metals, metabolic genetic diseases) Gentamycin Outdated tetracyclines	Diabetes, Interstitial nephritis AIDS Addison's disease
Minimal urine pH	>5.5	<5.5	<5.5
Urinary citrate excretion	↓	↑	↓
Plasma K^+ concentration	↓	↓	↑
Urine anion gap[†]	Positive	Positive	Positive
Associated features	Nephrocalcinosis/Nephrolithiasis	Fanconi's syndrome	Renal insufficiency
Renal defect	Distal H^+ secretion	Proximal HCO_3 reabsorption	Distal Na^+ reabsorption, K^+ secretion and H^+ secretion
NH_4^+ and Titratable Acid	↓↓	Normal	↓
Treatment	HCO_3 /Shohl's solution , thiazides diuretics	HCO_3 (maximum alkali required)	HCO_3 Fludrocortisone and potassium binders

1.Uremia occurs when total GFR is reduced by:
   a) 25%
   b) 50%
   c) 60%
   d) 80%

2.The term end-stage renal disease (ESRD) is considered appropriate when GFR falls to:
   a) 50% of normal
   b) 25% of normal
   c) 10 – 25% of normal
   d) 5 – 10% of normal

3.Feature of CRF include:
   a) Bland urinary sediment
   b) Isothenuria
   c) Broad waxy cast in urine
   d) All of the above

4.The most common cause of chronic renal failure is:
   a) Diabetes mellitus(D/M)
   b) Hypertension
   c) Glomerular diseases
   d) Interstitial diseases

5.What is oliguria:
   a) Excretion of less than 300 ml in 24 hours
   b) Excretion of less than 400 ml in 24 hours
   c) Excretion of less than 400 ml in 12 hours
   d) Excretion of less than 100 ml in 24 hours

6.Non – Oliguric renal failure is commonly seen in:
   a) Snake bite
   b) Hypovolemic shock
   c) Aminoglycoside toxicity
   d) Myeloma

7.Clinical features of CRF appear when renal function is reduced to:
   a) 70%
   b) 50%
   c) 30%
   d) 20% of normal

8.Convulsions are commonly precipitated in terminal renal failure by:
   a) Hyperkalemia
   b) Hypokalemia
   c) Water intoxication
   d) Hypermagnesemia

9.All of the following is seen in CRF except
   a) Hyperphosphatemia
   b) Hyponatremia
   c) Metabolic acidosis
   d) Hypomagenesmia

10.Half nail syndrome underlying cause:
   a) OFC
   b) ↑ capillary proliferation
   c) ↑ melanin deposition
   d) Ectopic calcification

11.Renal osteodystrophy differs from nutritional and genetic forms of osteomalacia in having:
   a) Hypocalcaemia
   b) Hypercalcemia
   c) Hypophosphatemia
   d) Hyperphosphatemia

12.The cause of pruritus in CRF patients:
   a) Uremic toxins
   b) Hyperuricemia
   c) Hyper kalemia
   d) Ectopic dermal calcification

13.The underlying cause of Half & Half nail syndrome:
   a) ↑ capillary proliferation
   b) Powdery deposition of urea & uric acid
   c) ↑ melanin deposition
   d) Ectopic calcification

14.Chronic reflux nephropathy causes:
   a) Membranous nephropathy
   b) Focal segmental glomerulosclerosis
   c) MPGN
   d) Lipoid nephrosis

15.Most characteristic GN in HIV is:
   a) FSGS
   b) MPGN
   c) MCD
   d) RPGN

16.HIV associated nephropathy is a type of:
   a) Membranous glomerulonephritis
   b) Immunotactoid glomerulopathy
   c) Collapsing glomerulopathy
   d) Fibrillary glomerulopathy

17.Collapsing glomerulopathy features –
   a) Tuft necrosis
   b) Mesangiolysis
   c) Proliferation of parietal epithelial cells
   d) Hypertrophy of visceral epithelial cells

18.Normal to enlarge sized kidneys in a patient with chronic renal failure is indicative of:
   a) Benign nephrosclerosis
   b) Chronic glomerulonephritis
   c) Chronic interstitial nephritis
   d) Primary amyloidosis

19.Central nervous system manifestation in chronic renal failure are commonly the result of all of the following, except:
   a) Hyperosmolarity
   b) Hypocalcemia
   c) Acidosis
   d) Hyponatremia

20.Which neuromuscular manifestation of uremia is progressive despite maintenance H/D:
   a) Encephalopathy
   b) Restless leg syndrome
   c) Paralysis
   d) Muscle cramps / myopathy

21.Restless leg syndrome (RLS) is seen in:
- a) Hypercalcemia
- b) Hyperphosphatemia
- c) Chronic renal failure
- d) Hyperkalemia

22.Salt losing nephritis or salt wasting nephropathy is a feature of:
- a) Interstitial nephritis
- b) Renal amyloidosis
- c) Lupus nephritis
- d) Post Streptococcal Glomerulonephritis

23.Chronic renal failure is often complicated by all of the following except:
- a) Myopathy
- b) Hemolytic uremic syndrome
- c) Peripheral neuropathy
- d) Ectopic calcification

24.Metabolic abnormality seen in ESRD:
- a) Metabolic acidosis-high anion gap
- b) Metabolic alkalosis
- c) Hypokalemia
- d) Hypercalcemia

25.In chronic renal failure there is:
- a) Decreased anion gap initially
- b) Normal anion gap initially
- c) Increased anion gap later on
- d) Normal anion gap later on

True statements:
- a) 1 & 4
- b) 1 & 2
- c) 3 & 4
- d) 2 & 3

26.Anemia of advanced renal insufficiency is best treated by:
- a) Blood transfusions
- b) Recombinant human erythropoietin
- c) Parenteral iron therapy
- d) Folic acid

27. Chronic renal failure with inappropriately high haemoglobin levels may be seen with:
- a) Hypertensive nephropathy
- b) Multiple myeloma
- c) Diabetic nephropathy
- d) Polycystic renal disease

28.All the following uremic features improve with dialysis except:
- a) Pericarditis
- b) Metabolic acidosis
- c) Myopathy
- d) Peripheral neuropathy

29.All the following uremic manifestations improve with dialysis except:
- a) Metabolic acidosis
- b) Uremic osteodystrophy
- c) Asterixis
- d) Nausea/vomiting/anorexia

30.In uremia all are reversed by dialysis except:
- a) Sexual dysfunction
- b) Pericarditis
- c) Uremic lung
- d) Neuropathy

31.The absolute indication for dialysis include the following:
- a) Persistent severe hyperkalemia
- b) Pulmonary oedema
- c) Hyperphosphatemia
- d) Acidosis

32. The neurological disorder seen in CRF patients on dialysis:
- a) Dementia
- b) Peripheral neuropathy
- c) Restless leg syndrome
- d) Encephalopathy

33. Following are the absolute indications for hemodialysis except:
- a) G I bleeding
- b) Convulsions
- c) Pericarditis
- d) Hyperkalemia > 6.5 meq/L

34. Dialysis may be complicated by the following except:
- a) Dementia
- b) Hypotension
- c) Scurvy
- d) CHF

35. Hemodialysis is useful in all except:
- a) Barbiturate poisoning
- b) Methanol poisoning
- c) Salicylate toxicity
- d) Digoxin toxicity

36. Not seen in CAPD:
- a) Malnutrition
- b) Coronary artery disease(CAD)
- c) Cystic bone disease
- d) Adynamic bone disease

37. Amyloid deposit in chronic hemodialysis consist of:
- a) β_2 amyloid protein
- b) Lambda light chain
- c) β_2 microglobulin
- d) Transthyretin

38. The best method for dialysis access in hemodialysis, in CRF pts is
- a) Jugular vein catheter
- b) Subclavian vein catheter
- c) Cimino Breschia fistula
- d) Femoral vein catheter

39. Dementia in a pt of CRF on chronic hemodialysis is due to:
- a) Aluminium toxicity
- b) Uremia
- c) Hypokalemia

d) Hypertension

40. The following statement is true:
a) Peritoneal dialysis is contraindicated in diabetic pts.
b) 5-yr mortality rate of hemodialysis is 5%
c) Peritoneal dialysis is very useful for the treatment of drug over dosages
d) Past history of repeated abdominal surgeries is a contraindication for peritoneal dialysis

41. Cyclosporine toxicity is
a) Cardiotoxic
b) Nephrotoxic
c) Hepatotoxic
d) Bone marrow suppression

42. Disease that does not recur in the graft kidney after renal transplant is:
a) Alport's syndrome
b) Amyloidosis
c) Good Pasture's Syndrome
d) Diabetic nephropathy

43. A renal transplant recurrence of the disease causing early graft failure occurs mostly with:
a) Lupus nephritis
b) DM nephropathy
c) MGN
d) MPGN

44. MC underlying cause of ARF in clinical practice
a) CHF
b) Diarrohea
c) BHP
d) Acute glomerulonephritis

45.Features of hepatorenal syndrome are all except:
a) Urine sodium less than 10 mmmol/L
b) Normal renal histology
c) Renal function abnormal even after liver becomes normal
d) Proteinuria less than 500 mg/dl

46. Which of the following statements is in-correct with regard to HRS:
a) Creatinine clearance less than 40 ml/min
b) Liver transplantation is the only life saving treatment modality
c) Urine osmolality lower than plasma osmolality
d) No improvement in renal fn after volume expansion with I/V fluids

47 .A seven yr old asymptomatic girl is found to have persistent hypertension. There is no significant history and urine examination is normal. Which of the following is the most likely cause;
a) Essential hypertension
b) Renal parenchymal disease
c) Cushing's syndrome
d) Coarctation of aorta

48. Renal vein thrombosis is most commonly associated with:
a) Diabetic nephropathy
b) MGN
c) MCD
d) MPGN

49. A 10 yr old child develops massive hematuria after 2 days of diarrhea. USG shows marked enlargement of both kidneys. The likely diagnosis is:
a) Acute pyelonephritis
b) DIC
c) HUS
d) Renal vein thrombosis

50. All are features of hemolytic uremic syndrome, except:
a) Hyperkalemia
b) Anemia
c) Renal microthrombi
d) Neuropsychiatric disturbances

51. All of the following statements are true about HUS except:
a) Uremia
b) Hypofibrinogenemia
c) Thrombocytopenia
d) Positive Coomb's test

52.A 7 yrs girl's parents gave history of fever for which she was treated with paracetamol following which the fever subsided. Later she developed seizures and altered sensorium. Urine exam. Revealed oxalate crystals on microscopy, blood anion gap and osmolality increased. The diagnosis is:
a) Paracetamol poisoning
b) Ethylene glycol poisoning
c) Renal tubular acidosis
d) Severe malaria

53. A 28 yr old boy met with an accident and sustained severe crush injury. He is most likely to develop:
a) ARF
b) Hypophosphatemia
c) Hypercalcemia
d) Acute myocardial infarction

54. A marked decline in renal function due to acute interstitial nephritis has been reported in association with all except:
a) Methicillin
b) Cephalothin
c) Heparin
d) Ampicillin
e) Furosemide

55. Necrotising papillitis is seen in all except:
a) Salicylate poisoning
b) Glomerulonephritis
c) Sickle cell anemia
d) Diabetes

56. Most important mechanism of AKI in multiple myeloma:
a) Hypercalcemia induced renal

b) Toxic ATN
c) Tubular obstruction due to myeloma casts
d) Hyperviscosity syndrome

57. Radiation nephritis is characterised by all except:
a) Hypotension
b) Rapidly developing azotemia
c) Massive proteinuria
d) Anemia

58. In hepatorenal syndrome, urine shows:
a) Significant proteinuria
b) Significant hematuria
c) A and b both
d) No abnormality

59. A person admitted in the casualty in a state of acute renal failure (ARF). Among the following which would be the most sensitive investigation to differentiate between reversible pre-renal ARF and established ARF?
a) Urinary volume
b) Proteinuria
c) Microscopy
d) Fractional excretion of Na^+

60. The differentiating factor between pre-renal and renal azotemia is:
a) Sodium fractional excretion
b) Creatinine clearance
c) Urine microscopy
d) Urine osmolality
e) All the above

61. Oliguric phase of ARF – all are seen except:
a) Hyponatremia
b) Hyperkalemia
c) Hypercalcemia
d) Anemia
e) Hypermagnesemia

62. Pre-renal azotemia is characterised by all of the following except:
a) Fractional excretion of $Na^+ < 1\%$
b) Urinary osmolality > 500 mosm/Kg
c) Urine output less than 400ml/day
d) Urinary sodium concentration > 40 meq/L
e) Reversible with replacement fluids

63.Interstitial nephritis is seen with all except:
a) Beta-lactam inhibitors
b) INH
c) Diuretics
d) Allopurinol

64.Renal papillary necrosis is almost always associated with one of the following conditions:
a) Diabetes mellitus
b) Analgesic nephropathy
c) Chronic pyelonephritis
d) Post streptococcal glomerulonephritis

65. Renal papillary necrosis can be caused by:
a) Phenacetin
b) Sulphonamides
c) Gentamycin
d) Penicillin

66. Most unlikely cause of acute tubular necrosis amongst the following is:
a) Severe bacterial infection
b) Massive burn
c) Severe crush injury in the foot
d) Rupture of aortic aneurysm

67. Causes of acute tubular necrosis include:
a) Radiocontrast agents
b) Paraproteins
c) Amphotericin B
d) Abruptio – placentae
e) All of the above

68. Investigations in a pt of Oliguria revealed; urine osmolality – 620 mosm/Kg. Urinary Na^+ 12 mmol/L. Urine/plasma urea ratio- 13:1. The most likely diagnosis:
a) Pre-renal acute renal failure
b) Acute tubular necrosis
c) Acute cortical necrosis
d) Urinary tract obstruction

69. All are features of acute renal failure (ARF) except:
a) Hypotension
b) Metabolic acidosis
c) Hyperkalemia
d) Hypertension

70. Plasma urea/creatinine ratio of 20:1 may be seen in:
a) Rhabdomyolysis
b) Ureteric calculi
c) Pre-renal failure
d) Chronic glomerulonephritis

71. All of the following are seen in oliguric phase of acute tubular necrosis, except:
a) Hypernatremia
b) Hypermagnesemia
c) Hyperuricemia
d) Hyperphosphatemia
e) Hyperkalemia

72. Tranexemic acid and ethamsylate are indicated in all except:
a) Hemoptysis
b) Hemetemesis
c) Malena
d) Hematuria

73.A 55 year old male diabetic patient having BP – 190/110 despite on 4 anti hypertensives past H/O CAD, TIA & intermittent claudication present. O/E renal artery bruit (+). Investigation of choice:
a) Colour dopplar USG
b) MR angio
c) Renal arteriography
d) Captopril enhanced plasma rennin assay

74. Urinalysis shows RBC casts: likely source is:

a) Kidney
b) Ureter
c) Bladder
d) urethra

75. Presence of which of the following correlates best with renal pathology:
a) hyaline cast
b) coarse granular cast
c) broad cast
d) epithelial cast

76. A boy is suffering from acute pyelonephritis. Most specific urinary finding will be:
a) WBC casts
b) Leucocyte esterase test
c) Nitrite test
d) Bacteria in gram stain

77. RBC casts in the microscopic examination of the urine is an indicator of:
a) Acute glomerulonephritis
b) Acute pyelonephritis
c) Chronic glomerulonephritis
d) Nephrotic syndrome

78. Diagnostic or specific feature of CRF is:
a) Broad casts
b) Elevated blood urea
c) Proteinuria
d) Bleeding diathesis
e) Acidosis with increased anion gap

79. Which of the following is normal cast in urine:
a) Granular
b) Waxy
c) Epithelial
d) Hyaline

80.A person is being evaluated for persistent metabolic acidosis. Blood tests show; Na 140, K 3, Ca 8, Mg 2, phosphate 3, pH 7.22, bicarbonate 16, and chloride 112. The plasma anion gap is:
a) 9
b) 15
c) 22
d) 25

81.Urinary anion gap an indication of excretion of;
a) Ketoacids
b) NH4+
c) H+ion
d) Na+ion

82. Kidney normally does not allow transglomerular passage of:
a) β_2 microglobulin
b) Lysozyme
c) Myoglobin
d) Immunoglobulin

83. Which of the following is not important as a defense mechanism for UTI:
a) Flushing effect of urine
b) Urea & prostatic secretions
c) Local WBC's
d) Surface immunoglobulin IgA

84. In differentiating glomerular proteinuria from tubular proteinuria, glomerular proteinuria is indicated by:
a) Proteinuria > 3.0 – 3.5 gm/day
b) Globulin > albumin
c) Albumin to β 2 microglobulin ratio of 100:1
d) Tamm Horsfall protein

85. All of the following may be associated with massive proteinuria except:
a) Aamyloidosis
b) Renal vein thrombosis
c) Polycystic kidneys
d) Microscopic polyangitis

86 .All of the following are renal diseases which may be present without proteinuria, except
a) Polycystic disease
b) Pyelonephritis
c) Glomerulonephritis
d) Hypokalemic nephropathy

87. Coloured urine is not seen in:
a) Quinine
b) Rifampin
c) Nitrofurantoin
d) Pyridium

88. CRF shows all except:
a) Hyperphosphatemia
b) Hyperuricemia
c) ↓ $t_{1/2}$ of insulin
d) ↓ serum vitamin D

89. Polyuria is a feature of all of the following except:
a) Hypocalcemia
b) Hypokalemia
c) Lithium toxicity
d) ADH deficiency

90.Consider the following conditions:
1. Central diabetes insipidus
2. Uncontrolled diabetes mellitus
3. Mannitol infusion
4. Post obstructive diuresis

Which of the above result in solute dieresis?
a) 1 and 2 only
b) 1, 2 and 3
c) 2, 3 and 4
d) 1, 3 and 4

91. Tamm Horsfall protein is : PGI
a) Normal urinary constituent
b) Tubular in origin
c) Abnormal urinary constituent
d) Seen in glomerular disease

92.Which of the following statements about orthostatic proteinuria true: PGI
a) Seen in recumbent position
b) Is benign

c) Future risk of nephrotic syndrome
d) < 500 mg/day

93.Presence of which of the following in the urine is diagnostic of glomerular injury:
a) Bright Red Cells
b) 20% dysmorphic RBCs
c) 100 RBC per high power field
d) β2 microglobulin

94. In hematuria of glomerular origin the urine is characterized by the presence of all of the following except:
a) Red Cell Casts
b) Acanthocytes
c) Crenated Red Cells
d) Dysmorphic Red Cells

95.On routine health check up URM in a person showed repeatedly minimal microscopic hematuria(isomorphic RBCs), protein (+), WBC casts +,UCS (N). What should be done next:
a) Considering cystitis, give a course of antibiotics
b) Considering Urolithiasis, start the patient on thiazide diuretics
c) Ask for 24 hour urinary Ca^{++} & uric acid estimation
d) Ask for ASLO titres

96. All of the following are features of Bartter's syndrome, except:
a) Hypokalemia
b) Hypermagnesemia
c) Hyperprostaglandin E
d) hypercalciuria

97. A 45-year-old black woman on chronic hemodialysis for renal failure due to uncontrolled hypertension has hematocrit of 22 percent with a mean red cell volume (MCV) of 89. Correct statements about her condition include which of the following?
a) A trial of erythropoietin is unlikely to improve her hematocrit because erythropoiesis is relatively unresponsive to this hormone in the face of chronic uremia
b) The patient may be experiencing chronic blood loss because of the use of heparin with dialysis or the abnormal hemostasis associated with chronic renal failure
c) Folic acid deficiency is possible, even though the anemia is normocytic

98. Intervention of choice in radiocontrast toxicity:
a) Hemoperfusion
b) Hemodialysis
c) Hemofilteration
d) Ultrafilteration

99. All of the following are examples of tubulointerstitial disorders of the kidney except:
a) Hypercalcemic nephropathy
b) Lupus nephritis
c) Gouty nephropathy
d) Hypokalemic nephropathy

100. All are true of nephrotic syndrome, except:
a) RBC casts in urine
b) Hypo-proteinemia
c) Oedema
d) Hyperlipidemia

ANSWER KEY:

1) D
2) D
3) D
4) A
5) B
6) C
7) D
8) C
9) D
10) A
11) D
12) D
13) C
14) B
15) A
16) C
17) D
18) D
19) A
20) D
21) C
22) A
23) B
24) A
25) D
26) B
27) D
28) C
29) B
30) A
31) A
32) A
33) D
34) C
35) D
36) C
37) C
38) C
39) A
40) D
41) B

42) A
43) D
44) B
45) C
46) C
47) B
48) B
49) D
50) D
51) D
52) B
53) A
54) C
55) B
56) C
57) A
58) D
59) D
60) E
61) C
62) D
63) B
64) A
65) A
66) D
67) E
68) A
69) D
70) C
71) A
72) D
73) C
74) A
75) C
76) A
77) A
78) A
79) D
80) C
81) B
82) D
83) D
84) A
85) C
86) C
87) A
88) C
89) A
90) C
91) A, B
92) B, D
93) B
94) C
95) C
96) B
97) B, C
98) C
99) B
100) A