9 RENAL REPLACEMENT THERAPY

1. List the GFR categories for Chronic Kidney Disease (CKD)?

1. **G1:** Normal or high (≥ 90 mL/min/1.73 m²).
2. **G2:** Mildly decreased (60–89 mL/min/1.73 m²).
3. **G3a:** Mildly to moderately decreased (45–59 mL/min/1.73 m²).
4. **G3b:** Moderately to severely decreased (30–44 mL/min/1.73 m²).
5. **G4:** Severely decreased (15–29 mL/min/1.73 m²).
6. **G5:** Kidney failure (< 15 mL/min/1.73 m²).

2. List the chronic indications for starting Renal Replacement Therapy (RRT)?

1. Failure of conservative treatment with progressive deterioration.
2. Persistent nausea and vomiting.
3. **Circulatory overload** unresponsive to loop diuretics.
4. Severe motor neuropathy.
5. **Uremic encephalopathy**.
6. Pericarditis.
7. Bleeding diathesis.
8. Hypertension unresponsive to treatment.
9. **Hyperkalemia** (serum K+ level > 7 mEq/L).
10. Metabolic acidosis.
11. High creatinine levels and decreased clearance (Cr.clearance < 10ml/min).

3. Identify the urgent indications for Renal Replacement Therapy in patients with AKI?

1. Fluid overload refractory to diuretic therapy.
2. **Severe hyperkalemia** (plasma K+ > 6.5 mEq/L) or rapidly rising levels.
3. Overt manifestations of uremia (pericarditis, encephalopathy, or unexplained mental status decline).
4. **Severe metabolic acidosis** (pH < 7.1).
5. Certain alcohol and drug intoxications.

4. List the absolute contraindications for dialysis?

1. Patient's refusal of dialysis.
2. **Severe extrarenal illness**, including:
   a. Severe cardiac disease.
   b. End-stage liver disease.
   c. Severe cerebrovascular disease.
   d. Advanced malignancy.

5. Enumerate the criteria for optimal dialysis?

1. Blood pressure controlled with minimal antihypertensive medications.
2. Normalized calcium-phosphate product without binders or supplements.
3. **Absence of intradialytic symptoms** (hypotension, cramps, nausea).
4. Absence of interdialytic symptoms.
5. No interference with ability to hold a job.
6. Normal protein appetite.
7. Neither alkalotic nor acidotic status.

8. Absence of left ventricular hypertrophy.
9. Hematocrit between 35-38% with minimal erythropoietin use.
10. No dialysis-related or access-related hospitalizations.
11. Normal triglyceride levels.
12. No evidence of amyloidosis.
13. Preservation of residual kidney function.
14. Life expectancy similar to living-related-donor transplant recipients.
15. Near-normal inflammation levels.

6. Define hemodialysis?

- Hemodialysis is a process where the **solute composition of blood is altered** by exposing it to a physiological solution (dialysate) across a **semipermeable membrane**.

7. List the factors affecting solute diffusion during dialysis?

1. **Concentration gradient:** Increasing the gradient increases the rate of solute transfer.
2. **Molecular weight and size:** Large molecular weight slows the transport rate.
3. **Membrane resistance:** Includes membrane thickness, number and size of pores, and the unstirred fluid layer.

8. Distinguish between osmotic and hydrostatic ultrafiltration?

1. **Osmotic ultrafiltration:** Depends on the osmotic pressure of the dialysate; higher pressure leads to more ultrafiltration.
2. **Hydrostatic ultrafiltration:** Depends on the transmembrane pressure (TMP); higher TMP results in more ultrafiltration.

9. List the three basic dialyzer designs?

① Coil dialyzer.
② Parallel plate dialyzer.
③ **Hollow fiber dialyzer.**

10. Identify the timing recommendations for creating permanent vascular access?

- Patients should be referred to a nephrologist/surgeon when they reach **CKD stage 4** (GFR < 30 ml/min/1.73 m^2).
- Permanent vascular access should be created **3–6 months before** the expected start of hemodialysis.

11. Enumerate the factors affecting solute clearance on hemodialysis?

1. **Blood flow rate:** Increasing flow (typically 200–600 ml/min) increases clearance.
2. **Dialysate flow rate:** Increasing flow (usually ~500 ml/min) increases clearance.
3. **Dialyzer efficiency:** Depends on surface area and pore size.
4. **Molecular weight of solute:** Small pores limit the removal of large molecules unless high-flux dialyzers are used.
5. **Time and frequency** of the dialysis session.

12. List the common complications encountered during hemodialysis?

1. **Hypotension** (the most common complication).
2. Muscle cramps.
3. Nausea and vomiting.
4. Headache.

5. Chest pain and back pain.
6. Itching (Pruritus).
7. Fever and chills.

13. List the less common but serious complications of hemodialysis?

1. Disequilibrium Syndrome.
2. Dialyzer reactions.
3. Arrhythmia.
4. **Cardiac tamponade.**
5. Intracranial bleeding.
6. Seizures.
7. Hemolysis.
8. Air embolism.

14. List the specific indications for choosing Peritoneal Dialysis?

1. Infants and very young children.
2. Patients with **cardiovascular or hemodynamic instability.**
3. Vascular access failure or inability to create access (especially in diabetics).
4. High risk for anticoagulants.
5. Patients desiring greater **freedom to travel.**

15. Classify the mechanical complications of Peritoneal Dialysis?

1. Pain during inflow or outflow.
2. **Outflow failure** (due to constipation or catheter malposition).
3. Pericatheter leakage.
4. Scrotal edema.
5. Intestinal perforation.
6. Cuff catheter erosion.

16. List the metabolic complications of Peritoneal Dialysis?

1. Hyperglycaemia.
2. Hyperlipidaemia.
3. Metabolic alkalosis.
4. **Protein depletion.**
5. Obesity.

17. Describe the diagnostic findings for peritonitis in PD?

1. Cloudy outflow.
2. Fever.
3. Abdominal pain and bowel symptoms (cramps, diarrhea, or constipation).
4. Peritoneal fluid WBC count **> 100/ml with > 50% PMNs.**

18. Compare Hemodialysis and Peritoneal Dialysis?

Feature	Hemodialysis (HD)	Peritoneal Dialysis (PD)
Location	Hospital, center, or home	Usually at home
Vascular Access	Required	Not required
Diet	More restricted	Less restricted
Residual Function	Short-lived	Long-lasting
Lifestyle	Lesser flexibility	Greater flexibility/travel freedom
Efficiency	High	Low

19. List the contraindications for Kidney Transplantation?

1. Patient refusal or psychosis.
2. Age more than 60 years (relative).
3. **Oxalosis**.
4. Active infection.
5. Unrepairable urologic abnormalities.
6. **Severe systemic diseases** (COPD, severe heart failure, liver failure).
7. Active peptic ulceration.
8. Malignancy.

20.Classify the types of kidney transplant rejection?

1. **Hyperacute:** Occurs immediately postoperative.
2. **Acute:** Occurs days to months postoperatively.
3. **Chronic:** Occurs months to years postoperatively.

21. List the complications associated with specific immunosuppressive drugs?

1. **Steroids:** Hypertension, D.M., atherosclerosis, bone disease, GIT bleeding, and cataracts.
2. **Azathioprine:** Bone marrow depression and hepatic dysfunction.
3. **Cyclosporine:** Nephrotoxicity, hepatotoxicity, hypertension, and D.M..