



Medicine

Nephrology

5th year – lecture 5

الدكتور
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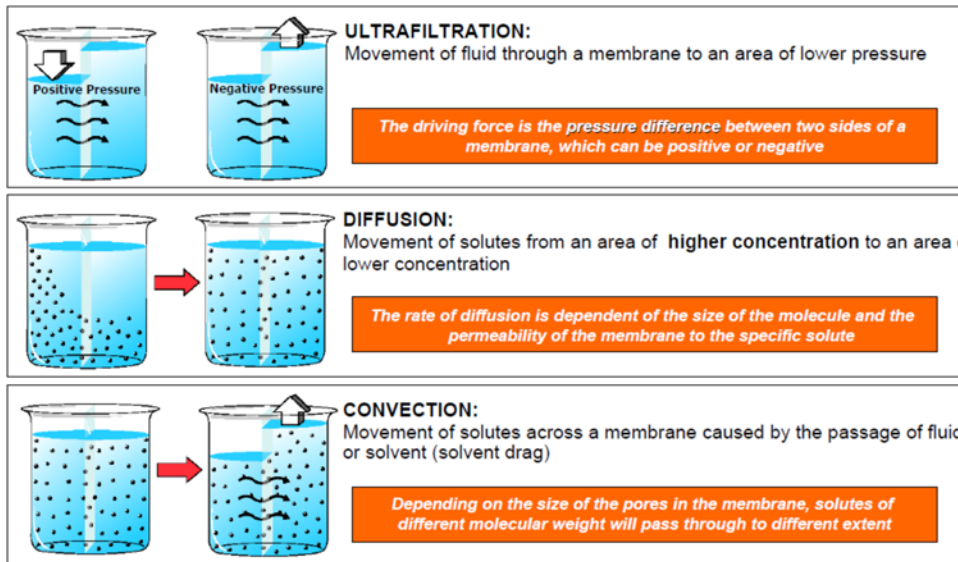
الاختصاص الدقيق بأمراض وزرع الكلى

اختصاص الطب الباطني

MBCbB, FICMS (Medicine), FICMS (Nephrology), CABMS (Nephrology)

Renal replacement therapy (RRT)

- Renal replacement therapy (RRT) may be required on a temporary basis in patients with AKI or on a permanent basis for those with advanced CKD.
- Transport Mechanisms : fluid(ultrafiltration),hemodialysis(diffusion),hemofiltration (convection).



- **Indications for Dialysis : absolute indications**
 1. uremic encephalopathy(acute confusional state)
 2. uremic pericarditis
 3. Refractory pulmonary edema , fluid overload.
 4. Refractory hyperkalemia
 5. Refractory severe metabolic acidosis
- **Relative indications:** 1)Clinically significant bleeding diathesis (uremic bleeding) due to uraemia-induced platelet dysfunction ,2)GI symptoms (nausea , vomiting) , 3)refractory renal anemia ,4)refractory hyperphosphatemia , 5)Persistent severe pruritus ,6) Restless leg syndrome .
- **hemodialysis:** blood is filtered across a semipermeable membrane removing accumulated toxic waste products, solutes (by diffusion) , through vascular access can be achieved through a central line (double lumen), an artificial AV graft, or an AV fistula (which is a surgical connection made between an artery and a vein to made venous vessel wall thickened “arterialization of veins”).

Complications of hemodialysis:

- Hemodialysis should be started gradually (duration of session < 2hours , blood flow < 200ml/min.) because of the risk of delirium and convulsions due to cerebral oedema (dialysis disequilibrium).

| i 15.37 Problems with haemodialysis | | | |
|-------------------------------------|--|--|--|
| Problem | Clinical features | Cause | Treatment |
| During treatments | | | |
| Hypotension | Sudden ↓BP; often leg cramps; sometimes chest pain | Fluid removal and hypovolaemia | Saline infusion; exclude cardiac ischaemia; quinine may help cramp |
| Cardiac arrhythmias | Hypotension; sometimes chest pain | Potassium and acid–base shifts | Check K ⁺ and arterial blood gases; review dialysis prescription; stop dialysis |
| Haemorrhage | Blood loss (overt or occult); hypotension | Anticoagulation Venous needle disconnection | Stop dialysis; seek source; consider heparin-free treatment |
| Air embolism | Circulatory collapse; cardiac arrest | Disconnected or faulty lines and equipment malfunction | Stop dialysis |
| Dialyser hypersensitivity | Acute circulatory collapse | Allergic reaction to dialysis membrane or sterilisant | Stop dialysis; change to different artificial kidney |
| Between treatments | | | |
| Pulmonary oedema | Breathlessness | Fluid overload | Ultrafiltration ± dialysis |
| Systemic sepsis | Rigors; fever; ↓BP | Usually involves vascular access devices (catheter or fistula) | Blood cultures; antibiotics |

(BP = blood pressure)

Peritoneal dialysis: peritoneum acts as a semipermeable membrane similar to hemodialysis filter

- advantages: independence , better rehabilitation rates
- available as continuous ambulatory (CAPD; 4-5 exchanges/d) or cyclic (automated PD) (CCPD; machine carries out exchanges overnight)

Table 18. Peritoneal Dialysis vs. Hemodialysis

| | Peritoneal Dialysis | Hemodialysis |
|------------------------|---|---|
| Rate | Slow | Fast |
| Location | Home | Hospital (usually) |
| Ultrafiltration | Osmotic pressure via dextrose dialysate | Hydrostatic pressure |
| Solute Removal | Concentration gradient and convection | Concentration gradient and convection |
| Membrane | Peritoneum | Semi-permeable artificial membrane |
| Method | Indwelling catheter in peritoneal cavity | Line from vessel to artificial kidney |
| Complications | Infection at catheter site Bacterial peritonitis Metabolic effects of glucose Difficult to achieve adequate clearance in patients with large body mass | Vascular access (clots, collapse) Bacteremia Bleeding due to heparin Hemodynamic stress of extracorporeal circuit Disequilibrium syndrome (headache, cerebral edema, hypotension, nausea, muscle cramps related to solute/water flux over short time) |
| Preferred When | Residual renal function Success depends on presence of residual renal function Hemodynamic instability | Comorbidities, no renal function Residual renal function not as important History of abdominal surgery |

Renal Transplantation

Renal transplantation offers the best chance of long-term survival in ESRD and is the most cost-effective treatment. All patients with ESRD should be considered for transplantation but many are not suitable due to a combination of comorbidity and advanced age (although no absolute age limit applies).

- 2 types: deceased donor, living donor (related or unrelated)
- living donor transplants have been shown to have better short- and long-term outcomes than deceased donor transplants
- kidney transplanted into iliac fossa, transplant renal artery anastomosed to external iliac artery of recipient.
- induction immunosuppression with IV ATG (thymoglobulin) or basiliximab, followed by maintenance oral immunosuppression with an oral immunosuppression cocktail (usually corticosteroids, calcineurin inhibitor, anti-metabolite)
- long-term monitoring of cyclosporin and tacrolimus levels are required

RENAL TRANSPLANT

| IMMUNOSUPPRESSION | | | |
|---|---------------------------------------|--|--|
| Class | Examples | Mechanism of Action | Adverse Events |
| Calcineurin inhibitor (can check levels) | Cyclosporine Tacrolimus (FK506) | Inhibits calcineurin-mediated activation of NFAT → blocks T-cell cytokine production | Nephrotoxicity (long-term fibrosis), HTN, tremor, insomnia, hirsutism (CsA only) |
| mTOR inhibitor | Sirolimus (Rapamycin) | Inhibits mTOR → blocks IL-2 production | Pulmonary edema, ↓ wound healing, hyperTG |
| Antimetabolite | Mycophenolate (Cellcept, Myfortic) | Inhibits de-novo purine synthesis | N/V/D |
| | Azathioprine | Purine analogue | BM suppression, N/V/D, hepatitis |

Nuclear factor of activated T-cells (NFAT)

Current absolute contraindications to transplantation

- Active sepsis
- Current uncontrolled malignancy
- Uncontrolled psychosis
- Active drug dependence
- Any medical condition (as HF) with shortened life expectancy (<1 to 2 years)
- Positive T cell Complement-dependent cytotoxicity (CDC) crossmatch

Complications

- increased risk of infections (bacterial, viral like CMV, fungal, opportunistic)
- new-onset DM (often due to prednisone and calcineurin inhibitors, especially tacrolimus)
- graft rejection (cellular or humoral (antibody mediated)), acute rejection: rise in Cr, fever, hematuria, graft site tenderness, oliguria .Diagnosis : graft biopsy .Treatment of cellular rejection :high dose steroid , ATG (antithymocyte globulin)
- cyclosporine or tacrolimus nephrotoxicity treated by monitoring drug level & ↓dose.