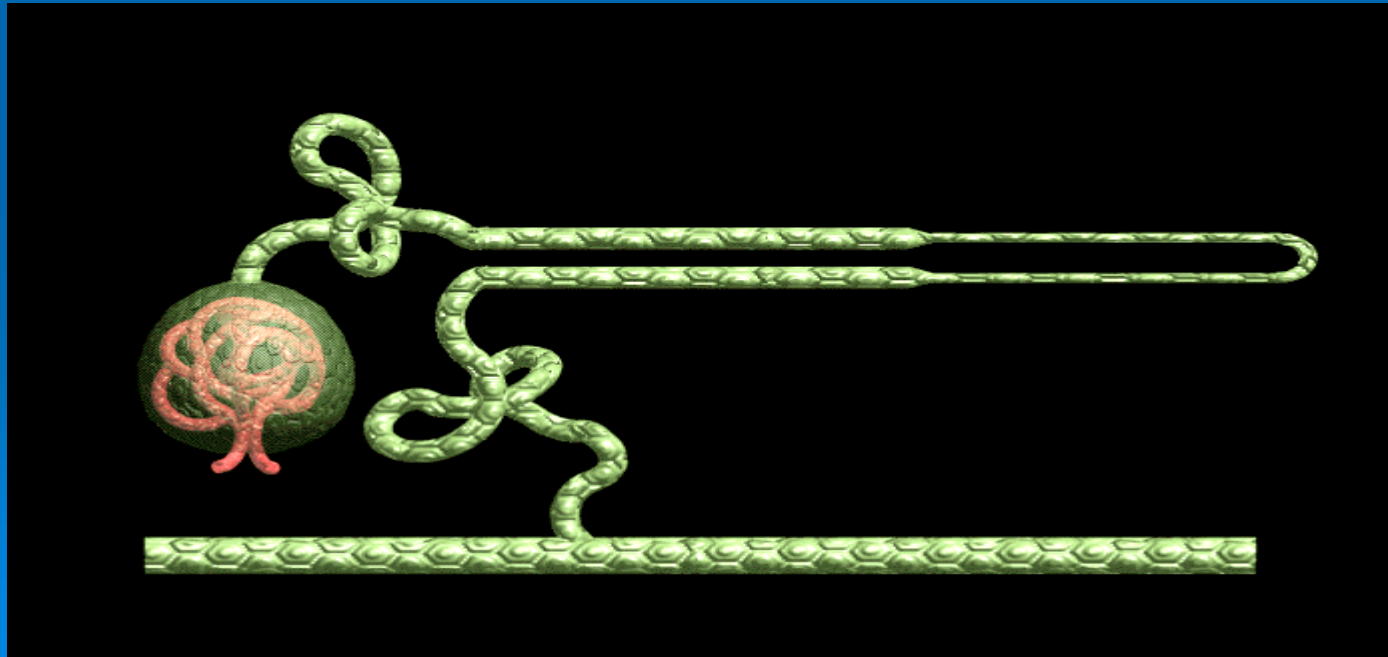


Surgery and Renal Failure



General loss of kidney function with alterations in volume regulation and ionic composition of body fluids and inadequate excretion of metabolic wastes.



Glomerular Filtration Rate

➤ Most practical measure of renal function

➤
$$\text{GFR(ml/min)} = \frac{(140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{serum creatinine}}$$

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$$\text{GFR(ml/min)} = \frac{(140 - \text{age}) \times \text{weight (kg)}}{72 \times \text{serum creatinine}} \times 0.15$$

Assumes stable creatinine concentration

Acute renal failure

- 5-10% of surgical patients
- 25% of patients receiving CPB
- Post-op – half of all requiring acute hemodialysis.
- Anesthetic agents, blood products, tissue injury, sepsis, antibiotics, surgical fluid loss, nephrotoxins

Acute renal failure

- Oliguric – less than 400cc urine per 24 hours
- Non-oliguric – large volumes of urine without clearance of protein metabolites
- Anuria – Bilateral artery occlusion, ureteral ligation, cortical necrosis, rapidly progressive glomerulonephritis

Acute Renal Failure

- Most common cause, post-op – ATN
 - sepsis, ischemia, nephrotoxins
 - pigmented granular casts
- Acute cortical necrosis
 - profound shock
 - disseminated intravascular coagulation
- Atheroemboli
 - vascular procedures
 - anticoagulants

Pre-renal

➤ Impaired renal perfusion

- Hypotension – sepsis, anaphylaxis, neurogenic shock, anesthesia
- Hypovolemia – hemorrhage, dehydration, third spacing
- Renovascular obstruction – embolic, atherosclerosis, venous thrombosis
- Cardiac failure – MI, cardiomyopathy, arrhythmia.

Post-renal

- Obstructive uropathy
 - Renal pelvis and ureters – stone, clot, tumor, infection, retroperitoneal fibrosis
 - bladder and urethra – obstructed bladder neck.
- Extravasation
 - trauma
- 5% of all cases of ARF

Intrarenal

➤ ATN

Ischemia

Nephrotoxins

- endogenous: pigments, crystals, or tumors (lysis or myeloma)
- exogenous: antibiotics, anesthetics
chemotherapeutic drugs, immuno-
suppresants, contrast, organic
solvents, dextran.

Intrarenal

➤ Glomerulonephritis

- postinfectious: streptococcal, viral, IAA
- Membranoproliferative
- Rapidly progressive: SLE, Goodpasture's, Polyarteritis nodosa,
- Serum sickness
- Thrombomicroangiopathy: HUS, TTP
DIC, malignant HTN

Intrarenal

➤ Interstitial nephritis

- Drugs: PCN, cephalosporins, sulfonamides, rifampin, NSAIDS, thiazides, cimetidine
- infection:
 - direct invasion – Staph, virus, fungi
 - indirect - exotoxin
- infiltration: lymphoma, leukemia, sarcoid
- idiopathic

Intrarenal

- Papillary necrosis
 - analgesics, infection, obstruction, DM
- Acute cortical necrosis
 - profound shock
- Atheroembolic syndrome

Prevention

- Maintain adequate intravascular fluid volume
- Maximize cardiac output
- Avoid hypotension
- Avoid NSAIDS – afferent arterioles
- Avoid Ace-I – efferent arterioles
- Avoid nephrotoxic agents
- Dopamine infusion - controversial

Prevention


- Carefully monitor levels of nephrotoxic agents
- Renal dosing adjustments
- Meticulous identification of urinary structures
- Diuresis
 - loop diuretics
 - mannitol
- Alkalinize urine

Diagnosis

	Prerenal	Intrarenal	Postrenal
Urine osm	> 500	< 350	variable
U/P _{urea}	> 8	< 3	variable
U/P _{creat}	> 40	< 20	< 20
Urine Na	< 20	> 40	> 40
FeNa	< 1	> 3	> 3

$$\text{FeNa} = \frac{U_{\text{Na}} \times P_{\text{creat}}}{P_{\text{Na}} \times U_{\text{creat}}}$$

Diagnosis

- Fluid challenge
 - Ultrasound
 - Mag-3 scan
 - CT
 - Angiography
 - contrast
 - MRI
 - Cystogram
- 

Management

➤ Correction of fluid and electrolyte abnormalities

Potassium

- 10% Calcium gluconate – EKG changes
- Insulin-glucose infusion
30u w/ 1L D₁₀ @ 200cc/hr
- Kayexalate
- NaHCO₃⁻

Management

- Hemodialysis
 - $K^+ > 5.5$ mEq/L
 - Acute fluid overload
 - BUN $>80-100$ mg/dl
 - persistent metabolic acidosis
 - lack of sufficient nutritional support
- CRRT or hemofiltration
 - avoids hypotension and bleeding
 - residual renal function
 - significant fluid overload

Elderly

- Progressive sclerosis of nephron
- Cr clearance decline 0.75 ml/min per year
- Decreased Na resorption
- Decreased proton excretion
- Decreased responsiveness to ADH
- Osmoreceptor function
- Limited bladder distensibility and emptying
- 10-50% asymptomatic bactiuria