Acute Renal Failure
Acute Renal Failure:

* Clinical Syndrome

* Sudden deterioration in renal Function

* Inability of kidneys to maintain fluid and electrolytes homeostasis

* 2-3% children, 8% neonates
Classified into 3 categories

1- Prerenal ARF

2- Intrinsic Renal ARF

3- Postrenal ARF
Pathogenesis and Causes

Prerenal ARF

* Diminished effective circulating arterial volume
* Inadequate renal perfusion
* Decreased GFR
* No evidence of kidney damage
Causes of Prerenal ARF

1- Dehydration
2- Hemorrhage
3- Sepsis
4- Hypoalbuminemia
5- Cardiac Failure
Intrinsic Renal (ARF)

* Renal parenchymal damage

* Sustained hypoperfusion / ischemia
Causes of Intrinsic Renal (ARF)

1- Glumerulonephritis

* Post streptococcal
* Lupus nephritis
* Henoch-schonlein purpura
* Membranoproliferative
* Anti-glomerular basement membrane
Causes of Intrinsic Renal ARF (cont)

1- Hemolytic uremic syndrome

2- Acute Tubular Necrosis

3- Renal vein thrombosis

4- Rhabdomyolysis

5- Acute interstitial nephritis

6- Tumor lysis Syndrome
Postrenal ARF

Obstruction of urinary tract

Causes

1- Posterior urethral valves
2- Ureteropelvic junction obstruction
3- Urolithiasis
4- Tumor
5- Hemorrhagic cystitis
6- Neurogenic bladder
Clinical Manifestation

Depends upon the cause
Diagnosis

Detailed History

Physical Examination
Investigations

1- Blood urea / creatinin
2- Electrolytes
3- CBC, platelet count
4- Urine RE
5- C₃
6- ASO titer
7- X-ray chest
8- Renal ultrasonography
9- Renal Biopsy
# Urinary Indices

<table>
<thead>
<tr>
<th>Urinary Indices</th>
<th>Prerenal ARF</th>
<th>Intrinsic ARF</th>
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</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td>$&gt;1.020$</td>
<td>$&lt;1.010$</td>
</tr>
<tr>
<td>Urine osmolality</td>
<td>$&gt;500$ mOsm/kg</td>
<td>$&lt;350$ mOsm/kg</td>
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<tr>
<td>Urine Sodium</td>
<td>$&lt;20$ mEq/L</td>
<td>$&gt;40$ mEq/L</td>
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<tr>
<td>Fractional Excretion</td>
<td>Na$&lt;1%$</td>
<td>$&gt;2%$</td>
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Treatment

Depends upon cause / complication
Bladder catheterization

(relieve obstruction & monitor urine output)
Volume Resuscitation

If no evidence of volume overload / cardiac failure

Isotonic saline 20ml/kg over 30 minutes

Severe hypovolemia require additional fluid boluses

Hypovolemic patient voids within 2 hours
Diuretic therapy

* Exclude hypovolemia

* Mannitol 0.5g / kg

* Furosemide 2-4mg/kg

* Continuous diuretic infusion

* dopamine 2-3mcg / kg / min
Fluid requirements

* 400ml / m² / 24 hrs

Plus Fluid equal to urine output

* Replace extra renal fluid loss ml for ml

* Fluid restriction in hypervolemic patients

* Daily monitor for fluid intake, urine & stool output, body weight & serum chemistries
Hyperkalemia (>6mEq / l)

* Leads to cardiac arrhythmia & cardiac arrest
* Peaked T wave, wide QRS, ST segment depression
* Stop exogenous sources of K⁺
* Calcium gluconate 10% 1ml/kg
* Sodium bicarbonate 1-2mEq / kg IV
* Regular insulin 0.1U/kg with 50% dextrose solution 1ml/kg over 1hr
* Kayexalate 1g/kg
* B-adrenergic agonist
* Dialysis
Metabolic acidosis

* Due to retention of hydrogen ions, phosphate & sulphate

* Treat if severe (PH<7.15, Serum bicarbonate <8mEq/l)

* Correct partially (PH to 7.20)

* Oral sodium bicarbonate
Hypocalcaemia

* Treat by lowering serum phosphorus

* Do not give I/V calcium except if tetany

* Low phosphorus diet

* Phosphate binder (calcium carbonate, Ca acetate)
Hyponatremia

* Mainly dilutional

* Fluid restriction

* I/V 3% NaCl if seizures or <120mEq/l

* mEq NaCl required = 0.6 X Wt (kg) X [125 - S.Na + (mEq/l)]
GIT Bleeding

* Uremic platelet dysfunction

* Increased stress

* Heparin exposure

* Give $H_2$ blocker (Ranitidine)
Hypertension

* Diuretic

* Isradipine  0.05 - 0.15mg/kg/24hrs

* Amlodipine  0.1 - 0.6mg/kg/24hrs

* Propranolol  0.5 – 8mg/kg/24hrs

* Labetalol  4-40mg/kg/24hrs
Neurogenic Symptoms

* Headache, Seizures, Lethargy
* I/V Diazepam
* Treat precipitating cause
Anemia

* Generally mild

* Hemodilution

* Packed red blood cells if Hb < 7 g/dl

* Use fresh, washed RBCs
Nutrition

* Restrict Na+, K+ & Phosphorus

* Protein restriction

* Parenteral hyperalimentation
Dialysis

Indications

* Volume overload with hypertension refractory to diuretics
* Persistent Hyperkalemia
* Severe metabolic acidosis
* Neurological symptoms
* BUN > 100-150 mg/dl
* Calcium /Phosphorus imbalance with hypocalcemic tetany
Types of dialysis

1- Intermittent hemodialysis

2- Peritoneal dialysis

3- Continuous renal replacement therapy
**Prognosis**

* Depends entirely on underlying disease
* AGN has very low mortality (<1%)
* ARF related to multiorgan failure has high mortality (≥90%)
* Recovery is likely if ARF due to HUS, ATN, AIN or tumor lysis syndrome
* Recovery is unusual when ARF due to rapidly progressive GN, bilateral renal vein thrombosis, bilateral cortical necrosis
Thank You