

Acute Renal Failure

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ARF : definition

- Rapid decline of renal function (hours to days)
- Decrease in GFR
- Retention of nitrogenous waste products
- Fluid, electrolyte and acid-base disturbance
- Oliguria or anuria is frequent but not invariable.

Types of ARF:

- **Pre-renal** (renal hypoperfusion, parenchyma intact) - 55%
- **Renal** (direct involvement of renal parenchyma or microvasculature) - 40%
- **Post-renal** (urinary tract obstruction) - 05%

Pre-renal ARF : Causes

- Hypovolemia
 - Fluid loss
 - Blood loss
- Low cardiac output (cardiogenic shock)
- Decreased effective circulatory volume
 - Liver cirrhosis
 - Hypoalbuminaemia
- Altered renal - systemic vascular resistance ratio

Intrinsic Renal ARF : Causes

- Disease of glomeruli or renal microvasculature
- Acute tubular necrosis
- Interstitial nephritis
- Renovascular obstruction

Post Renal ARF : Causes

- Ureteric
- Bladder neck
- Urethra

Pre Renal ARF

- Most common form of ARF
- Can complicate any disease that induces hypovolaemia, low cardiac output, systemic vasodilatation
- Rapidly reversible after restoration of blood pressure and renal blood flow



- Pre renal ARF and ischemic ARF are part of a spectrum of manifestation of renal hypoperfusion
- Occurs most frequently in patients undergoing major cardiovascular surgery or after severe trauma, haemorrhage, sepsis and volume depletion.

Nephrotoxic ARF

- Diverse pharmacologic agents involved
- Incidence increases in elderly, pre existing CRF, true or “effective” hypovolemia
- Concomitant exposure to other toxins

Nephrotoxic ARF : Pathophysiology

- Intrarenal vasoconstriction e.g. ****radiocontrast agents****, cyclosporine and tacrolimus
- Direct toxicity to renal tubule e.g. Aminoglycosides, amphotericin B, cisplatin, haemolysis, rhabdomyolysis, light chain protein, uric acid.

Changing pattern of ARF in the recent years

- Increasing use of radiocontrast material for various diagnostic and therapeutic purposes leads to more and more cases of contrast related ARF
- Most cases of CIN are either preventable or treatable

CIN : Diagnosis

- $>25\%$ or > 0.5 mg/dl rise in serum creatinine above baseline value within 24-48 hrs of contrast exposure

CIN : Prevalence

- 3rd common cause of hospital acquired ARF(after *hypotension and *surgery)
- 3rd common cause of ARF in Cardiac care unit (after *congestive heart failure and *cardiac arrest)

CIN : Pathophysiology

- Not fully elucidated
- Proposed mechanisms :
 - Vasoconstriction
 - Direct toxic effect of the contrast agents on tubular epithelial cells

CIN: Risk factors

- Non modifiable :
 - Pre existing renal insufficiency
 - Older age
 - DM

>>>CIN: Risk factors

■ Modifiable risk factors

- Volume of contrast media
- Type of contrast media
- Dehydration
- Low serum albumin level(<35mg/dl)
- Concomitant use of ACEI, Frusemide, NSAID

Using logistic regression analysis, Cochran et al. found **five** risk factors that predicts at risk patients with high probability :

- Age >55 yrs
- Proteinuria
- Abnormal baseline S. creatinine
- Use of high osmolar contrast medium.
- Pre existing renal disease.

CIN : Prognosis

- High rate of recovery after CIN
- But prolongs hospital stay and utilization of resources (e.g. dialysis / CRRT)
- Increase in mortality.

CIN : Prevention

- Assessment of presence of risk factors before use of contrast.
- Oral or IV hydration for patients at risk 12 hours before to 12 hours after the procedure
- Routine prophylactic use of N-Acetylcysteine in high risk patients
- Pretreatment with theophylline with hydration
- Non-ionic iso osmolar contrast agent is better than high or low osmolar contrast agent

Analgesic Nephropathy

- ATN
- Chronic TIN : Analgesic Nephropathy
- Glomerulonephropathy : Minimal change

Common causes of ARF in Bangladesh

- Diarrheal disorder
- Poor obstetric care
 - Hyperemesis gravidarum
 - Ante partum hemorrhage
 - postpartum hemorrhage
- Falciparum malaria
- Snake bite
- Road traffic accident (Crush injury)

Prevention of ARF

- **Ischemic ARF** : Close attention to cardiovascular function and intra vascular volume restoration (prompt correction of dehydration or blood transfusion in case of hemorrhage)
- **Nephrotoxic ARF** : Tailoring the dosage of nephrotoxic drugs to body size and GFR. Adjusting the drug dose according to blood level e.g. aminoglycosides, cyclosporin, tacrolimus.

Treatment

- No specific therapies for ischemic or nephrotoxic ARF.
- Focus on
 - Elimination of Haemodynamic abnormality
 - Elimination of toxin
 - Avoidance of additional insult
 - Treatment of complication

Treatment *cont*

- Examples
 - Packed cell for severe haemorrhage
 - Isotonic saline for GI loss
 - Positive inotropes for cardiac failure

Any specific ?

- ANP
- Low dose dopamine
- Loop diuretic
- Ca channel blocking agents
- Prostaglandin analogues
- Antioxidants
- Antibodies against leukocyte adhesion molecule.

.....failed to provide consistent benefit.....

Any specific ?

- GN or vasculitis may respond to glucocorticoid, alkylating agents, plasmapheresis depending of primary pathology.
- Post renal ARF : Trasurethral or suprapubic catheter provide temporary relief

Supportive measures

- If hypervolemic : Salt and water restriction
- Frusemide is used in ARF only in volume overload states
- No role of low dose dopamine
- Metabolic acidosis usually not treated unless Bicarb $< 15\text{mmol/L}$ or PH < 7.2
- Hyperphosphatemia : Low phosphate diet
- Nutrition : Sufficient calorie to prevent catabolism
- Protein : 0.6 gm/kg/day of high biological value.

Indication of dialysis

- Absolute :
 - Symptoms and signs of uraemia like recurrent vomiting, neurological manifestations, pulmonary oedema
 - Refractory hyperkalemia, severe metabolic acidosis
 - Most nephrologist initiate early dialysis when serum creatinine $>5\text{mg/dl}$

Renal replacement therapy

- Recent evidence suggest that more intensive HD (e.g. daily rather than alternate day dialysis) is superior and confers improved survival in ARF once dialysis is required.)
- CRRT(CAVHD, CVVHD, CAVH, CVVH) :
 - For those patients who are haemodynamically unstable specially in ICU / CCU setting

Outcome

- Mortality rate of ARF : Approx 50%
- Die from sequel of primary illness that induces ARF
- NOT from ARF itself



Thank you