WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 14, 1175-1184. Review Article ISSN 2277– 7105

AN OVERVIEW ON RENAL FAILURE

Madhuri Y.*, Hema Soundarya P., Narendra Babu A., Bhargav Kumar N.

Chalapathi Institute of Pharmaceutical Sciences, Chalapathi Nagar, Lam, Guntur-522034.

Article Received on
20 Sept. 2017,

Revised on 10 October 2017,
Accepted on 31 October 2017

DOI: 10.20959/wjpr201714-10056

***Corresponding Author**
Madhuri Y.
Chalapathi Institute of Pharmaceutical Sciences, Chalapathi Nagar, Lam, Guntur-522034.

ABSTRACT

Renal failure is the most common kidney disorder in both male and female which is caused due to renal tubular dysfunction and can also be caused due to changes in creatinine level and blood urea nitrogen. Renal failure is of two types, namely acute renal failure (ARF) and chronic renal failure (CRF) or chronic kidney disease (CKD). From the present scenario 75% million people are suffering with renal failure. The present review consults the classification, etiology, pathophysiology, signs and symptoms, diagnosis and treatment of renal failure.

KEYWORDS: Acute renal failure, chronic renal failure, glomerular filtration, treatment.

INTRODUCTION

Renal failure is the bio-chemical abnormality and refers to an elevation in the blood urea nitrogen (BUN) & creatinine levels. It implies decrease in renal function resulting in the retention of nitrogenous wastes. Renal failure is of two types namely acute renal failure and chronic renal failure. The term acute renal failure commonly used to describe an abrupt decrease in GFR / the more clinically available index of renal function. A sudden and severe reduction in the GFR and kidney that is usually reversible over days. Chronic renal failure occurs when there is irreversible damage to about 75% of nephrons. Chronic renal failure is the progressive, irreversible deterioration of renal function. ARF may proceed into CKD if not treated properly.[1]

I. ACUTE RENAL FAILURE

EPIDEMIOLOGY

75% million people are suffering with ARF it was mainly caused by poor fluid intake, the persons treated with NSAIDS, ACE Inhibitors.

It is estimated that about one in five men and one in four women between the ages of 65 and 74 and half of people aged 75 or more have ARF.

It can develop at any age and various conditions can lead to ARF.[10]

CLASSIFICATION

Based on etiology ARF is classified into 3 types.

1. **Prerenal ARF:** Stem from impaired renal perfusion, which may result from

a) Reduced arterial blood volume (Eg: dehydration, hemorrhage, vomiting, diarrhea)

b) Urinary losses from excessive diuresis

c) Decreased cardiac output

d) Renal vascular obstruction

e) Severe hypotension.

2. **Intrinsic ARF:** Reflects structural kidney damage resulting from any of the following conditions:

a) Acute tubular necrosis (ATN) the leading causing of ARF, may be associated with exposure to nephrotoxic aminoglycosides, anesthetics, organic metals.

b) Ischemic injury (eg: surgery, circulatory collapse, severe hypotension.)

c) Acute glomerulonephritis.

d) Tubular obstruction, as from hemolytic reactions or uric acid crystals

e) Renal vasculitis.

3. **Postrenal ARF:** Results from obstruction of urine flow anywhere along the urinary tract including:

a) Urethral obstruction, as from calculi, uric acid crystals or thrombi.

b) Bladder obstruction, as from calculi, thrombi, tumors, or infection.

c) Urethral obstruction, as from strictures, tumors, or prostatic hypertrophy.

d) Extrinsic obstruction, as from hematoma, inflammatory bowel disease, or accidental surgical ligation.[6]

RISK FACTORS[5]

MODIFIABLE	UNMODIFIABLE
Progressive fall in urine	Age
Sepsis	Family history
Ischemia	Genetics
Lack of breathing	

PATHOPHYSIOLOGY: ARF progress in three phases[4]

a) Initiating phase

- The initiating phase is defined as the time between the renal insult and the point at which external factors no longer reverse the damage caused by the obstruction or other cause of ARF. This phase may not be well defined clinically and may escape notice of diagnosis.
- Urine output may drop markedly to400 ml/day or less (oliguria). In some patients, urine output falls below 100ml/day (anuria). Oliguria may last for hours or as long as 4-6 weeks. However, it has been shown that 40%-50% of ARF patients are not oliguric or anuric.
- Nitrogenous waste products accumulated in the blood.

→ Azotemia reflects urea accumulation due to impaired glomerular filtration and concentration trating capacity

→ Serum creatinine concentration, sulfate, phosphate, and organic acid levels climb rapidly.

- The sodium concentration falls below normal from intracellular fluid shifting and dilution
- Hyperkalemia occurs due to the accumulation of organic acids(metabolic acidosis). If potassium intake is not restricted or body potassium is not removed, hyperkalemia results. Without treatment, hyperkalemia may lead to neuromuscular depression and paralysis, impaired cardiac conduction, respiratory muscle paralysis, cardiac arrest and ultimately death.

b) Maintenance phase

- This phase begins when urine output rises above 500ml/day-typically after several days of oliguria. A rise in urine output or a “diuretic response” may not be seen in non-oliguric patients.
- Urine output rises in increments of several milliliters to 300-500ml/day. Urine output may double from day-to-day in the initial recovery period.
- Azotemia and associated laboratory findings may persist until urine output reaches 1000-2000ml/day.

- The maintenance phase carries a risk of fluid and electrolyte abnormalities, GI bleeding, infection, and respiratory failure.

c) Recovery phase:

During the recovery phase, renal function gradually returns to normal. Most recovered renal function appears in the first 2weeks; however, recovery of renal function may continue for year. Residual impairment may persist indefinitely.[4]

CLNICAL FEATURES[6]

- Decreased jugular venous pressure
- Decreased skin turgor
- Tachycardia
- Orthostatic dizziness
- Blood in urine
- Thirst
- Decreased kidney function
- Fever
- Arthralgia
- Mimic glomerulonephritis.
- Flank pain
- Poor appetite
- Decreased urine out put
- Dehydration

COMPLICATIONS[6]

- Hyponatremia.
- Hyperkalemia.
- Hyperphosphatemia.
- Hypocalcaemia.
- Metabolic acidosis.

DIAGNOSIS

- Patient history
- Physical examination:

❖ Based on signs and symptoms of kidney disease.

- Urine analysis:

❖ Includes examination /identification on proteins, glucose, ketones, blood & nitrites.

❖ Measurement of urine P^H and urine specific gravity or osmolality.

❖ Urine osmolality typically rises in prerenal ARF due to increased secretion of ADH.

- Radio graphic findings

❖ Ultra sound (detect upper urinary tract obstructions).

❖ Kidney, ureter/ bladder radiography

(a) Urinary tract calculi

(b) Enlarged kidneys, suggesting ATN

(c) Asymmetrical kidneys, suggesting unilateral renal artery disease, ureteral obstruction or chronic pyelonephritis.[6]

Radionuclide scans

(a) Bilateral differences in renal perfusion, suggesting serious renal disease.

(b) Bilateral differences in dye excretion, suggesting parenchymal disease (or) obstruction as the cause of ARF.

(c) Diffuse, slow, dense radio nuclide uptake.

Computed tomography (CT)

May provide better visualization of an obstruction.

- Renal biopsy: May be performed in selected patients when other test results are given negative.[6]

MANAGEMENT

(1) Conservation management

(a) Fluid management (500-1000ml/day should be included in fluid balance calculation).

(b) Dietary measures like low protein diet, fruits, vegetables and salt substitutes containing potassium should be limited or avoided.

(2) Management of Bio-chemistry alterations.

Treatment of hyperkalemia

- Decreasing the intake of potassium in diet or tube feeds.
- Exchanging the potassium across the gut lumen using potassium binding resins
- Promoting intracellular shifts in potassium with insulin, dextrose solutions and beta agonists.[4]

TREATMENT

Treatment of fluids overload and edema.

Diuretics

- Osmotic diuretics

  Eg: mannitol, urea, glycerol.
- Loop diuretics

Eg: furosemide, bumetanide.

- ❖ Loop diuretics bind to luminal side of Na^+-K^+-$2Cl^-$, co-transport and block its function.
- ❖ There is increased excretion of Na+ and Cl^- in the urine.
- Onset of action: Administered through I.V (within minutes) Oral dose (several minutes)
- Duration of action: oral dose (6-8hrs), for I.V (2-3hrs).[7]

Surgery

Renal transplantation (rehabilitation).[8]

Dialysis

Hemodialysis

- Blood is pumped through a dialysis machine to remove waste products and excess fluids
- It is generally done three times a week and takes between 3 and 5 hours per session

Peritoneal dialysis

- It works on the same principle as hemodialysis but here your blood is cleaned while still inside your body rather than in a machine by adding clean fluid to your abdomen.[4]

Alternative therapy

Nutritional therapy

- Dietary proteins.
- Caloric requirement.
- Food and fluids (K^+, P^+. banana, citrus fruits, coffee are restricted.[4,7,8]

II. CHRONIC RENAL FAILURE

CLASSIFICATION

GFR< 60ml/min/1.73m^2 → kidney damage

↓ (abnormalities)

In blood and urine

1) Stage-1: kidney damage with a normal / increased GFR >90ml/min/1.73m^2
2) Stage-2: kidney damage with or a mildly decreased GFR (60-89 ml/min/1.73m^2).
3) Stage-3: signifies moderate reductions in GFR (30-59ml/min/1.73m^2).
4) Stage-4: GFR of 15-29ml/min/1.73m^2).
5) Stage-5: kidney failure/GFR of<15ml/min/1.73m^2)[3].

EPIDEMIOLOGY

- 56 million people are suffering from the CKD according to worldwide. In that our Indians are suffering less with CKD but more with AKD.
- A systemic review and meta-analysis of observational studies estimated CKD prevalence in general populations worldwide found a consistent estimated global CKD prevalence of 11-13%. The majority of causes are stage 3.
- CKD was mainly observed in older patients and the persons who have DM.[8]

ETIOLOGY

- DM is the leading cause of CKD.
- Hypertension is the second leading cause of CKD.
- Glomerulonephritis, which includes a wide variety of lesions caused by immunologic, vascular and others.[2]

RISK FACTORS

- Myocardial infraction.
- Rhabdomyolysis.
- Decreased blood flow.
- Obstruction.
- Hemolytic uremic syndrome.
- African ancestry.
- Family history.
- Diabetes mellitus.
- Hypertension.
- Autoimmune disease.[8]

PATHOPHYSIOLOGY

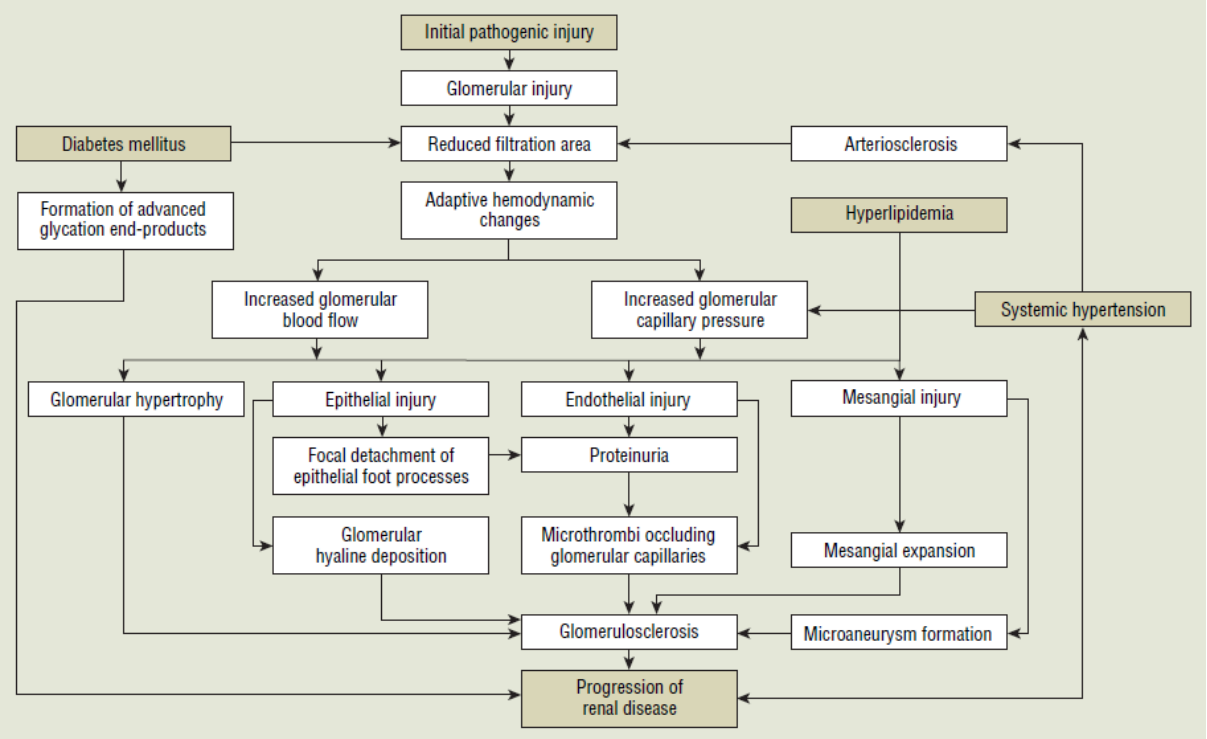

Figure-1: Pathophysiology of chronic renal failure[6]

CLINICAL FEATURES

Odema, abdominal distension, hypertension, polycystic kidney

Uremic (fatigue, weakness, shortness of breath, etc,)

Itching, vomiting, bone pain, cold intolerance, metabolic taste in mouth, weight gain, malaisc, dry skin.[2]

COMPLICATIONS

Amyloidosis, uremic bleeding,(potentially results of platelet abnormalities)

Endocrine disorders, GI (nausea, vomiting, appetite)

Immune (impaired cell mediated immunity).[2]

DIAGNOSIS

1. Physical examination (fundoscopy and pericardial examination).
2. Imaging studies (CT,MRI,SCANNINGS).
3. Renal biopsy.
4. Screening of disease conditions that effect long term kidney functions including diabetes, blood glucose control, high blood pressure, taking kidney toxic drugs, heart diseases enlarged prostate kidney stone.

5. Checking glomerular filtration rate.
6. Blood is tested for creatinine, urea, urea creatinine ratio, blood urea nitrogen.
7. Blood is also tested for electrolytes and minerals like sodium, potassium, calcium phosphates, magnesium.[6,9]

TREATMENT

Dialysis

Hemodialysis, peritoneal dialysis, dialyzer and dialysis access.[5,6]

Transplantation

Recipient selection.

Donor selection.[5,6]

Therapy

Used to treat edema and hypertension

1. ACE inhibitors- captopril, enalapril, lisinopril, fosinopril.
2. DIURETICS: a) osmotic diuretics- mannitol, urea, glycerol.

b) Loop diuretics-frusemide, ethacranic acid.

c) Thiazide diuretics-chlothiazide.

3. Beta adrenergic blockers-proponalol, atenolol.[3]

REFERENCE

1. Kumar, Abbas, Fausto, Mitchell, Robbin's Basic Pathology published by Salindees of 8th edition.
2. Joseph T. Dipiro, Barbara G. Wellss pharmacotherapy hand book published by 6thedition.
3. Ross and Willson, Anne Waugh, Allison Grant, Anatomy and Physiology in Health and Illness, published by Churchill Living stone of 9th edition.
4. Leon Shargel, Alan H. Mutnic, Paul F. Souney, Larry N. Swanson, Comprehensive pharmacy review, published by Wolters Kluwer/ Lippincott Williams and Wilkins of 8th edition.
5. Brain R. Walker, Nicki R. Colledge, Stuart H. Ralston, Ian D. Penamam, Davis son's Principles of medicine, published by Churchill Vingstone Elseware of 7th edition.
6. Kasper, Hauser, Braunwald, Longo, Fauci, Jameson, Harrison's principles of internal medicine of 16th edition.

7. Series editors are Richard A. Harvey, Pamela C. Champe and collaborating editors are Richard Finkel, Luingi X. Cubeddu, Michelle A. Clark, Lippincott's Illustrated Reviews, and Pharmacology, published by Wolters Kluwer / Lippincott Williams and Wilkins of 4th edition.
8. Bertram G. Katzung, Basic and Clinical Pharmacology published by Mc Graw Hill Lange of 10th edition.
9. www.news-medical.net/health/renal-failure-diagnostic-approach.aspx by Dr. Annanya Mandal.
10. www.worldkidneyday.org/faqs/chronic-kidney-disesase/