**Renal Failure Prof.Abdulrazzaq Al Salman**

**Acute renal failure**: The new terminology acute kidney injury (AKI):

AKI is a condition in which the glomerular filtration rate is abruptly reduced, causing a sudden retention of endogenous and exogenous metabolites (urea, potassium, phosphate, sulfate, creatinine, administered drugs) that are normally cleared by the kidneys. The urine volume is usually low (<400 mL/day). If renal concentrating mechanisms are impaired, the daily urine volume may be normal or even high (*high-output or nonoliguric renal failure*). In extreme cases, anuria occurs

(urine output completely shuts down) in acute kidney injury.

The causes of AKI are listed

**I. Prerenal:** The term *prerenal* denotes inadequate renal perfusion or lowered effective arterial circulation. The most common cause

 1. Dehydration(due to renal or extrarenal fluid losses from diarrhea, vomiting, excessive use of diuretics, and so on.)

 2. Vascular collapse due to sepsis, antihypertensive drug therapy,

“third spacing”

 3. Reduced cardiac output.

Prerenal causes are usually reversible if treated promptly, but a delay in therapy may allow it to progress to a fixed intrinsic renal failure

(eg, acute tubular necrosis).

*Clinical feature*: patients usually complain of thirst or of dizziness in the upright posture ( orthostatic dizziness). Weight losses reflect the degree of dehydration. Physical examination frequently reveals decreased skin turgor, collapsed neck veins, dry mucous membranes, and, most importantly, excessive orthostatic or postural changes in blood pressure (defined as a systolic drop >20 or a diastolic drop >10 mm Hg) and pulse.

*Management*: The urine volume is usually low. Accurate assessment

may require bladder catheterization followed by hourly.

Rapid intravenous administration of 300–500 mL of physiologic saline is the usual initial treatment. Urine output is measured over the subsequent 1–3 hours. A urine volume increase of >50 mL/h is considered a favorable response that warrants continued intravenous infusion.

In states of dehydration, fluid losses must be rapidly corrected to treat oliguria. If oliguria and hypotension persists in a well-hydrated patient, vasopressor drugs are indicated in an effort to correct the hypotension associated with sepsis or cardiogenic shock. Pressor agents that restore

systemic blood pressure while maintaining renal blood flow and renal function are most useful. However, the previously touted benefits of renally dosed dopamine (1–5 μg/kg/min) have not been proven. A more promising agent might be fenoldopam, a direct dopamine A-1 receptor agonist.

The other causes of AKI are classified on the basis of their involvement with vascular lesions, intrarenal disorders, or postrenal disorders.

**II. Functional**–hemodynamic

1. Angiotensin-converting enzyme inhibitor drugs

2. Nonsteroidal anti-inflammatory drugs

3. Cyclosporine; tacrolimus (calcineurin inhibitors)

4. Hepatorenal syndrome

**III. Vascular**

1. Atheroembolism

2. Dissecting arterial aneurysms

3. Malignant hypertension

**IV. Parenchymal (intrarenal)**

*1. Specific:*

 a. Glomerulonephritis

 b. Interstitial nephritis

 c. Toxin, dye induced(toxic nephropathies)

 d. Hemolytic uremic syndrome.

Usually the history shows some salient data such as sore throat or upper respiratory infection, diarrheal illness, use of antibiotics, or intravenous use of drugs, Henoch-Schonlein purpura, systemic lupus erythematosus, and scleroderma. Human immunodeficiency virus (HIV)infection may present with HIVassociated nephropathy.

 Laboratory Findings:

GUE/ many red or white cells and multiple types of cellular and granular casts. usually reveals dysmorphic red cells in the urine.

Blood test/Components of serum complement are often diminished (due to activation and consumption). In a few conditions, circulating immune complexes can be identified. Serologic tests may disclose systemic diseases such as lupus erythematosus (eg, anti-neutrophil antibody, antidouble-stranded DNA antibodies, anti-Smith antibodies).

Thrombocytopenia and altered red cell morphologic structure are noted in peripheral blood smears in the hemolytic uremic syndrome. Rapidly progressive glomerulonephritis can be evaluated with tests for ANCA (antineutrophil cytoplasmic antibodies) and anti-GBM titers (anti-glomerular basement membrane antibodies).

Renal biopsy/Light microscopic examination shows characteristic changes of glomerulonephritis (ie, crescents within Bowman’s capsule, acute interstitial nephritis, or glomerular capillary thrombi (in hemolytic uremic syndrome). Immunofluorescence microscopy showing immune deposits helps toward the diagnosis of rapidly progressive glomerulonephritis

US/sonography is preferable to rule out obstruction.

Treatment:Therapy is directed toward removing the underlying injurious constituent, for example, eradication of infection, removal of antigen, elimination of toxic materials and drugs, suppression of autoimmune mechanisms, removal of autoimmune antibodies, or a reduction in effector-inflammatory responses. Immunotherapy may involve drugs (corticosteroids) or the temporary use of plasmapheresis. Initiation of supportive dialysis may be required .

*2. Nonspecific*: Nonspecific intrarenal causes of acute kidney injury include

 a. Acute tubular necrosis

 b. Acute cortical necrosis(associated with intrarenal intravascular coagulation and has a poorer prognosis than the former).

These forms of acute kidney injury usually occur in hospital settings. Various morbid conditions leading to septic syndrome–like physiologic disturbances are often present.Degenerative changes of the distal tubules are believed to be due to ischemia. With dialysis, most of these patients recover—usually completely—provided intrarenal intravascular coagulation and cortical necrosis does not occur.

Laboratory Findings

GUE/The specific gravity is usually low or fixed in the 1.005–1.015 range. Urine osmolality is also low (<450 mOsm/kg and U/P osmolal ratio <1.5:1). Urinalysis often discloses tubular cells and granular casts; the urine may be muddy brown. If the urine is heme positive, but no red cells are seen on microscopy, one must be concerned about the presence of pigment nephropathy (myoglobinuria or hemoglobinuria).Tests for differentiating myoglobin pigment are available.

Treatment/If there is no response to the initial fluid or mannitol challenge,the volume of administered fluid must be sharply curtailed to noted losses. An assessment of serum creatinine and blood urea nitrogen and of the concentrations of electrolytes is necessary to predict the possible use of dialysis.With appropriate regulation of the volume of fluid administered,maintenance of nutritional intake to provide a caloric content of 30–35 kcal/kg is used to correct or reduce the severity of the catabolic state accompanying acute tubular necrosis.Serum potassium must be closely monitored to ensure early recognition of hyperkalemia.

**Prognosis:**Most cases are reversible within 7–14 days. Residual renal damage may be noted, particularly in elderly patients.

**V. Postrenal**

1. Calculus in patients with solitary kidney

2. Bilateral ureteral obstruction

3. Outlet obstruction

4. Leak, posttraumatic.

Radionuclide renal scans may show a urine leak or, in cases of obstruction, retention of the isotope in the renal pelvis.

Ultrasound examination often reveals a dilated upper collecting

system with deformities characteristic of hydronephrosis.

Cystoscopy and retrograde ureteral catheterization demonstrate

ureteral obstruction.

Treatment/relieve the obstruction by treating the underline cause.

**Chronic renal failure:** A variety of disorders are associated with CKD. Either a primary renal process (eg, glomerulonephritis, pyelonephritis, congenital hypoplasia) or a secondary one (owing to a systemic process such as diabetes mellitus or lupus erythematosus) may be responsible. Superimposed physiologic alterations secondary to dehydration,infection, obstructive uropathy, or hypertension may put a borderline patient into uncompensated chronic uremia.

*Clinical feature*/ With milder CKD, there may be no clinical symptoms. Symptoms such as pruritus, generalized malaise, lassitude,forgetfulness, loss of libido, nausea, and easy fatigability .Growth failure is a primary complaint in preadolescent patients.

Most patients with CKD have elevated blood pressure secondary to volume overload or from hyperreninemia.

The pulse and respiratory rates are rapid as manifestations of anemia and metabolic acidosis. Clinical findings of uremic fetor, pericarditis, neurologic findings of asterixis, altered mentation, and peripheral neuropathy are present only with severe, stage V CKD. Palpable kidneys suggest polycystic disease.

The urine volume varies depending on the type of renal disease. Proteinuria can be variable. Urinalysis examinations may reveal mononuclear white blood cells (leukocyturia) and occasionally broad waxy casts, but usually the urinalysis is nonspecific and inactive.

 Renal sonograms are helpful in determining renal size (usually small) and cortical thickness (usually thin) and in localizing tissue for percutaneous renal biopsy.

Renal biopsies may not reveal much except nonspecific interstitial

fibrosis and glomerulosclerosis.

Treatmen:

The use of angiotensin-converting enzyme inhibitors and angiotensin receptor blockers in slowing down renal decline has been well documented, especially in the diabetic population with significant proteinuria.

Aldosterone antagonists to optimize blood pressure control, patients need to be followed closely for potential hyperkalemia.

Lipid lowering drugs.

Overall, management should be conservative until it becomes impossible for patients to continue their customary lifestyles. Restriction of dietary protein (0.8–1.0 g/kg/d), potassium, and phosphorus is recommended. As well, maintenance of close sodium balance in the diet is necessary.

Use of oral bicarbonate (0.5–1 mEq/kg/d) can be helpful when moderate acidemia occurs. Anemia can be treated with recombinant erythropoietin given subcutaneously (aiming for hemoglobin levels between 11.0 and 12.0 g/dL . Prevention of possible uremic osteodystrophy and secondary hyperparathyroidism requires close attention to calcium and phosphorus balance.

Phosphate-retaining antacids and calcium or vitamin D supplements

may be needed to maintain the balance.

**Renal Replacement Therapy:**

**A. Chronic Peritoneal Dialysis**

Chronic peritoneal dialysis is used electively or when circumstances

(ie, no available vascular access) prohibit chronic hemodialysis. Ten percent of dialysis is done with this treatment.

Improved soft catheters can be used for repetitive peritoneal lavages. In comparison to hemodialysis, small molecules (such as creatinine and urea) are cleared less effectively than larger molecules, but excellent treatment can be accomplished. Intermittent thrice-weekly treatment (IPPD), continuous cycler-assisted peritoneal dialysis (CCPD), or chronic ambulatory peritoneal dialysis (CAPD) is possible.With the latter, the patient performs 3–5 daily exchanges using 1–2 L of dialysate at each exchange. The dialysate contains a high glucose concentration and the peritoneal surface serves as the semipermeable membrane. Bacterial contamination and peritonitis are becoming less common with improvements in connection technology. Over time, many patients will transition to hemodialysis due to either peritoneal membrane failure (eg, peritoneal sclerosis, adhesions) or inadequate dialysis as native renal clearance of solutes deteriorates.

**B. Chronic Hemodialysis**

Chronic hemodialysis using semipermeable dialysis membranes

is now widely performed. Access to the vascular system is provided by an arteriovenous fistula, vascular grafts (with autologous saphenous vein or synthetic material), or by a percutaneous permcatheter (placed either surgically or with interventional radiology). Most dialyzer membranes

nowadays are made with biocompatible materials (less blood–membrane reactions). Body solutes and excessive body fluids can be easily cleared by using dialysate fluids of known chemical composition. Newer, high-efficiency membranes (high/flux) are serving to reduce dialysis treatment

time.

Treatment is intermittent—usually 3–5 hours three times weekly. Computer modeling, using measurements of urea kinetics, has provided more precise hemodialysis prescriptions. Treatments may be given in a kidney center, a satellite unit, or the home. Home dialysis is optimal

because it provides greater scheduling flexibility and is generally more comfortable and convenient for the patient, but only 20% of dialysis patients meet the requirements for this type of therapy.

Common problems with either type of chronic dialysis include infection, bone symptoms, technical accidents, persistent anemia, and psychological disorders.

Nephrectomy in dialysis patients should be performed in cases of refractory hypertension, reflux with infection, and cystic disease with recurrent bleeding and pain. The dialysis patient can occasionally have acquired renal-cystic disease. Such patients need close monitoring for the development of in situ renal cell carcinoma.

Despite these medical, psychological, social, and financial difficulties, most patients lead productive lives while receiving dialysis treatment.

**C. Renal Transplantation**

After immunosuppression techniques and genetic matching were developed, renal allotransplantation became an acceptable alternative to maintenance hemodialysis. Improved short-term transplant results are now noted owing to the development of newer immunosuppressant drugs. Currently employed posttransplant drugs include prednisone, mycophenolate mofetil (and its enteric-coated formulation),cyclosporine, tacrolimus, and sirolimus. There are a number of novel medications under investigation that inhibit different pathways in the allorecognition mechanism, including a variety of injectable bioagents. The great advantage of transplantation is reestablishment of nearly normal and constant body physiology and chemistry. The disadvantages include bone marrow suppression, susceptibility to infection, oncogenesis risks, and the psychological uncertainty of the allograft’s future. Most of the disadvantages of transplantation are related to the medicines given to counteract the rejection.Later problems with transplantation include recurrent disease in the transplanted kidney and an increased incidence

of cancer. Genitourinary infection appears to be of minor importance if structural urologic complications (eg, leaks) do not occur.

 Nephrology centers, with close cooperation between medical and surgical staff, attempt to use these treatment alternatives of dialysis and transplantation in an integrated fashion.