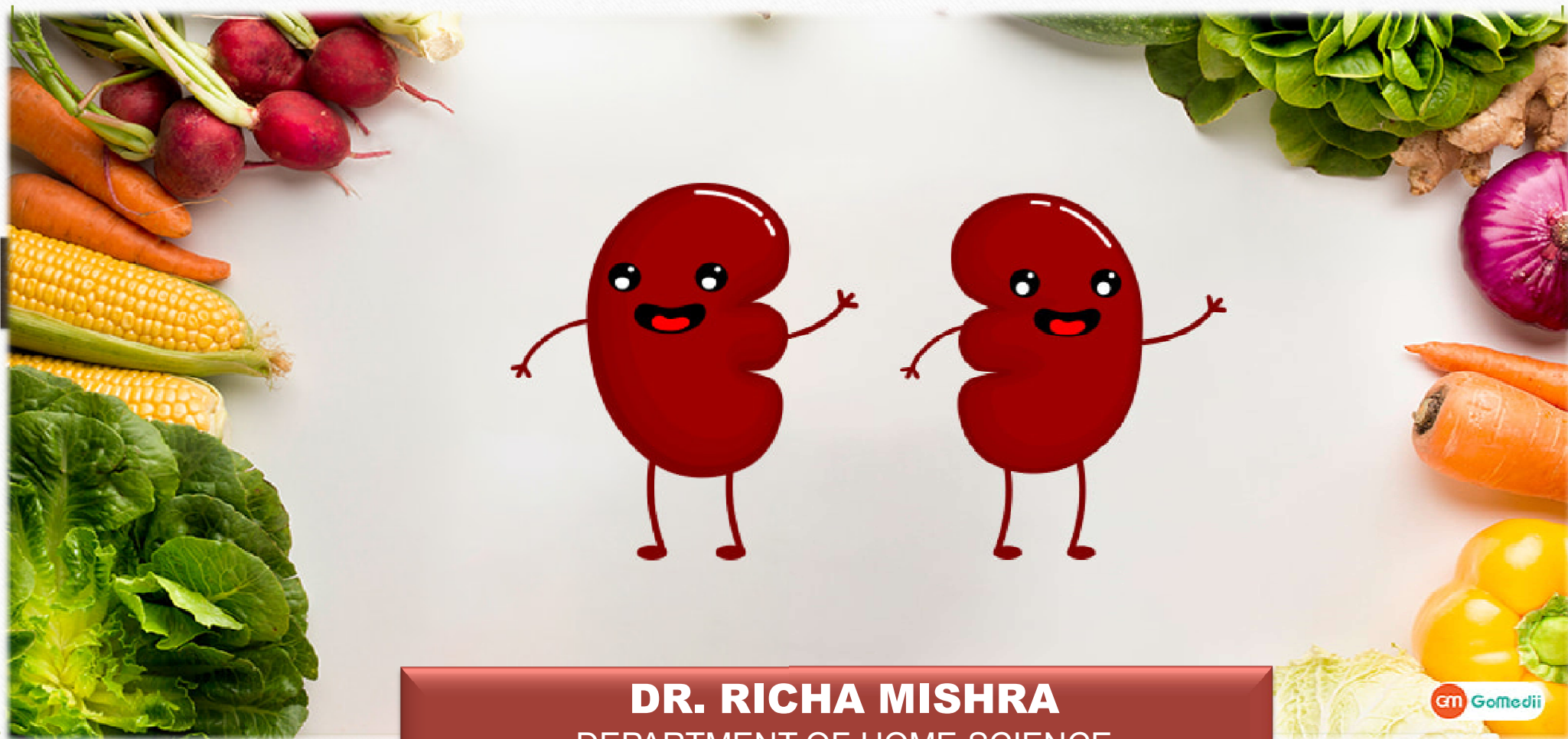


RENAL DISEASES AND THEIR DIETARY MANAGEMENT (PART I)

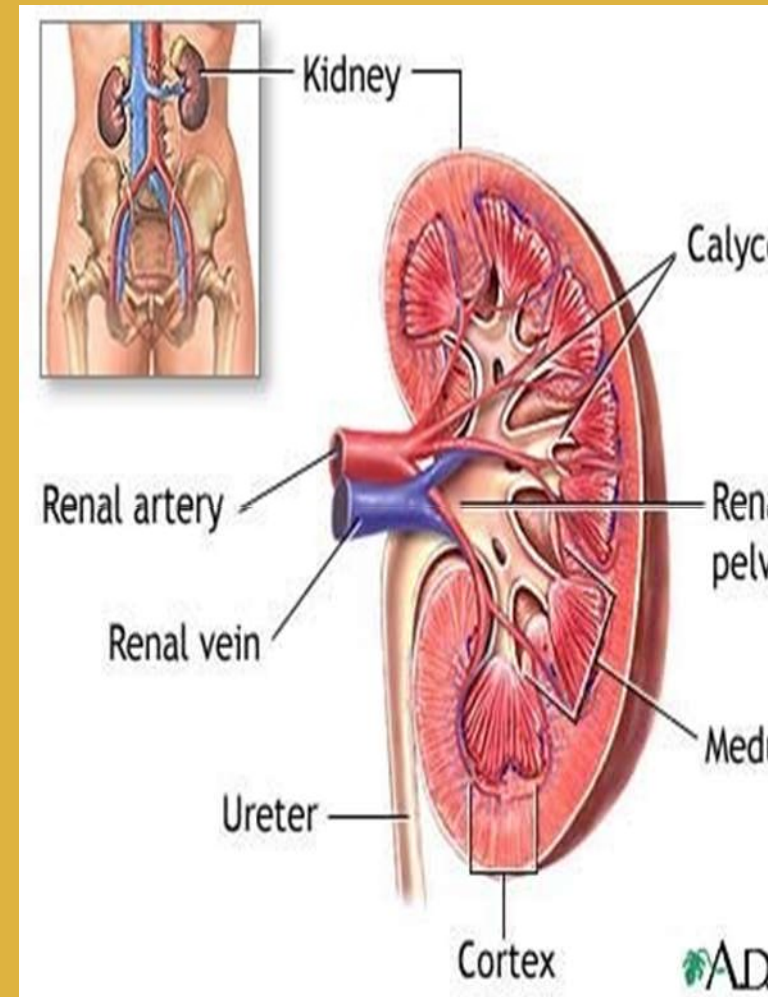


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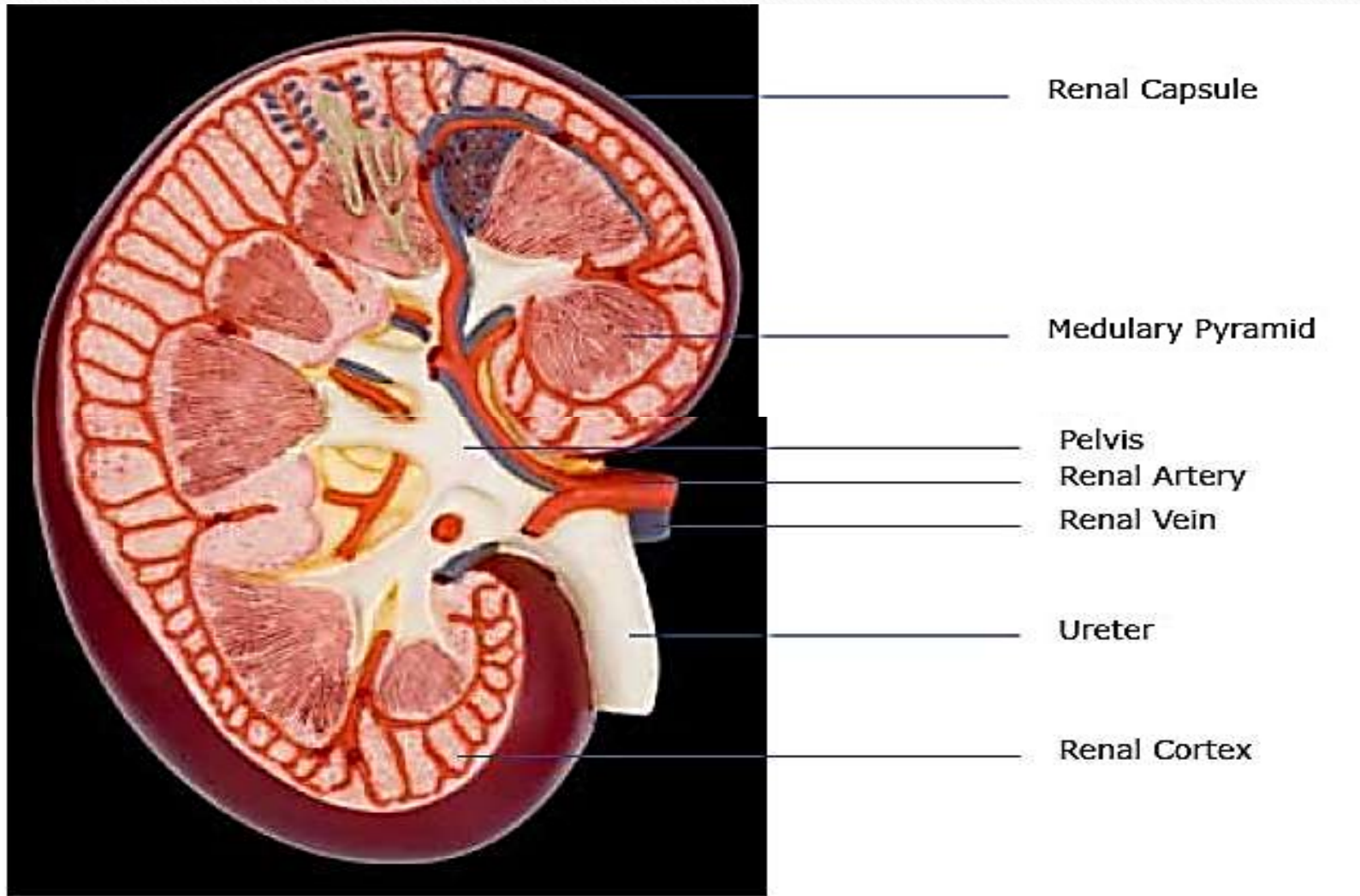
- **The kidneys are essentially regulatory organs which maintain the volume and composition of body fluid by filtration of the blood and selective reabsorption or secretion of filtered solutes.**
- **The renal arteries, which is connected to aorta, directly supplies impure blood to kidneys.**
- **After filtration blood is returned to the inferior vena cava through the renal veins.**
- **A pair of bean-shaped organs located at the posterior wall of the abdomen**

- **Dimensions**

- 11 cm long, 6 cm wide and 3 cm thick
- weighs about 160g



ANATOMY OF KIDNEY



Renal Capsule – outer membrane that surrounds the kidney; it is thin but tough and fibrous

Renal Pelvis – basin-like area that collects urine from the nephrons, it narrows into the upper end of the ureter

Calyx – extension of the renal pelvis; they channel urine from the pyramids to the renal pelvis

Cortex – the outer region of the kidney; extensions of the cortical tissue, contains about one million blood filtering nephrons

Nephron – these are the filtration units in the kidneys

Medulla – inner region of the kidney contains 8-12 renal pyramids. The pyramids empty into the calyx.

Medullary pyramids – formed by the collecting ducts, inner part of the kidney

Ureter – collects filtrate and urine from renal pelvis and takes it to the bladder for urination

Renal Artery – branches of the aorta brings waste-filled blood into the kidney for filtration in the nephrons. The renal artery is further subdivided into several branches, called **Capillaries**, inside the kidney. Each minute, kidneys receive **20%** of the blood pumped by the heart. Some arteries nourish the kidney cells themselves.

Renal Vein – Carries back the filtered blood from the kidneys to heart through the inferior vena cava

STRUCTURE OF THE NEPHRON

- **The nephron is the unit of the kidney that does ultrafiltration of the blood and processes the removal of waste and excessive substance through urine.**
- **Each nephron is an extremely fine tube that measures about 30-55mm long.**
- **There are about 1,000,000 nephrons in each human kidney**

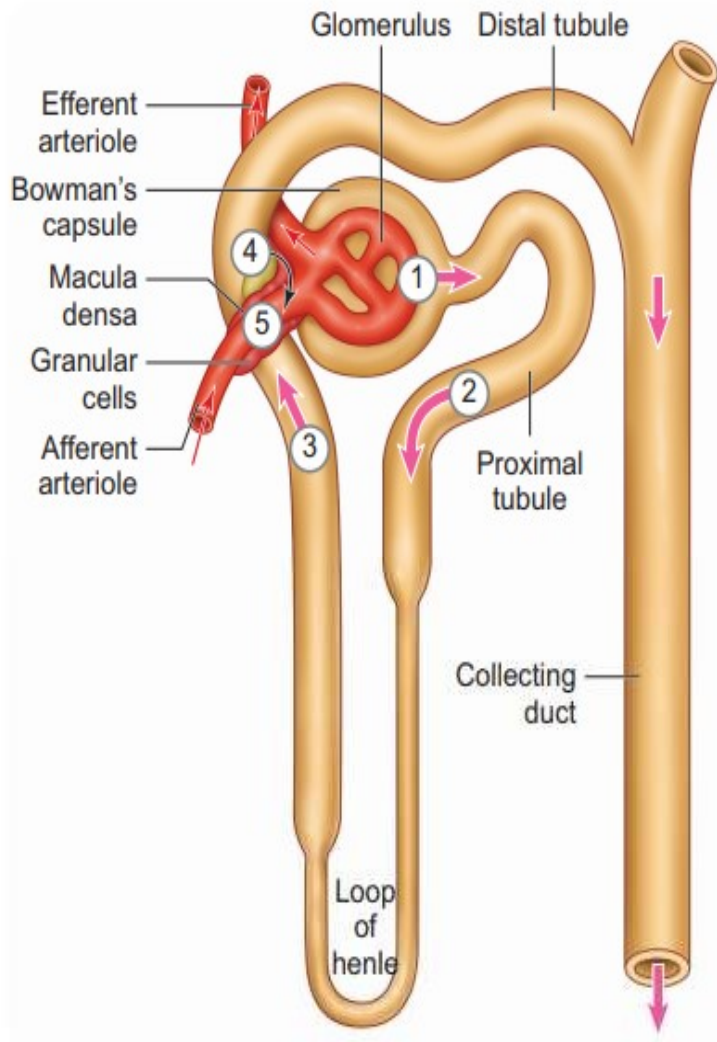


Figure 8.4 Structure of a Nephrons

- **Renal Artery** – brings waste-filled blood from the aorta to the kidney for filtering in the nephron.
- **Glomerulus** – each glomerulus is a cluster of blood capillaries surrounded by a **Bowman's capsule**. It looks similar to a ball of tangled yarn.
- **Proximal convoluted tubule (PCT)**

Thick Ascending limb of the loop of Henle

Distal convoluted tubule

Renal Vein – when filtration is complete, blood leaves the nephron to join the renal vein, which removes the filtered blood from the kidney

Arterioles – blood is brought to and carried away from the glomerular capillaries by two very small blood vessels—the afferent and efferent arterioles.

OVERVIEW OF KIDNEY FUNCTIONS

- **Excretion of wastes and other foreign substances.**
- **Regulation of blood ionic composition.**
- **Regulation of blood pH.**
- **Production of hormones.**
- **Regulation of blood pressure.**
- **Regulation of blood volume.**
- **Maintenance of blood osmolarity.**
- **Regulation of blood glucose level.**

Healthy kidney

Functions:

Sodium and water removal

Waste removal

Hormone production

Unhealthy kidney

Problems:

Fluid overload

Elevated wastes such as:

- urea
- creatinine
- potassium

Changes in hormone levels controlling:

- blood pressure
- making red blood cells
- uptake of calcium

RENAL DISEASE

❑ **GLOMERULAR DISEASE**

- **Glomerulonephritis**
- **Nephrotic Syndrome**

❑ **DISEASE OF TUBULE AND INTERSTITIUM**

- **Acute renal Failure**
- **Chronic Interstitial nephritis**
- **Medullary Cystic Disease**
- **Fanconi's Syndrome**
- **Renal tubular Acidosis**
- **Pyelonephritis**

❑ **PROGRESSIVE NATURE OF RENAL DISEASE**

- **Chronic Renal Disease/ Chronic Renal Failure/**
- **End Stage renal Disease (ESRD)**

ASSESSMENT OF RENAL FUNCTION

BIOCHEMICAL PROFILE: Measurement of Blood Plasma, Urea, Creatinine, Blood Urea Nitrogen, RFT, Electrolyte, Alakaline Phosphatase.

Glomerular filtration Rate (GFR)

➤ **Formula for calculating GFR**

$$\text{GFR} = UV/P$$

where,

- **U= Creatinine concentration in urine**
- **V= Volume of urine excreted in one minute**
- **P= Creatinine concentration in plasma**

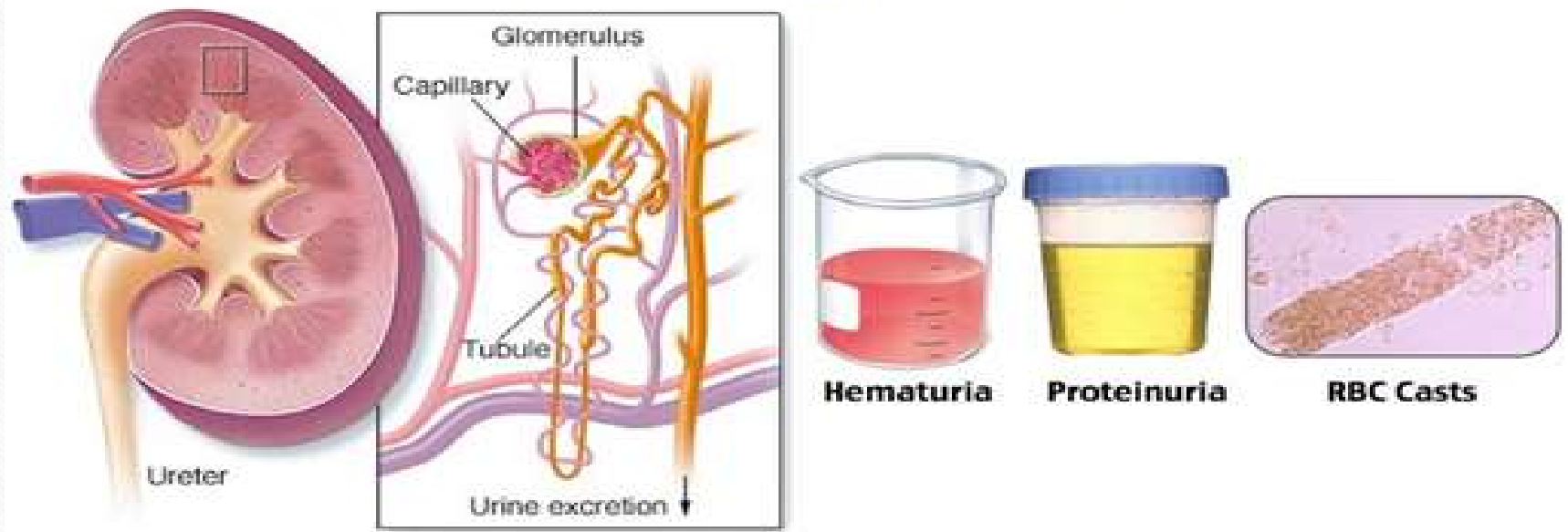
GFR= 100-125 ml/min /1.73 m² is normal.

Estimated GFR (Cockcroft-Gault equation).

- **GFR for men = $((140 - \text{Age}) \times \text{Weight}) / (72 \times \text{Creatinin (mg/dl)})$**
- **GFR for women = $((140 - \text{Age}) \times \text{Weight}) / (72 \times \text{Creatinin (mg/dl)}) \times 0.85$**
- **24hours urinary Protein**
- **Urine Routine Microscopic**

GLOMERULAR DISEASE

Glomerulonephritis



Glomerulonephritis is a group of diseases that injure the part of the kidney that filters blood (called glomeruli). Other terms you may hear used are nephritis and nephrotic syndrome. When the kidney is injured, it cannot get rid of wastes and extra fluid in the body. If the illness continues, the kidneys may stop working completely, resulting in kidney failure.

Glomerulonephritis is an inflammatory process affecting the glomeruli, the small blood vessels in the head of Nephron.

It is most common in its acute form in children between 3-10 years of age and young adults, although a few cases (10 percent or more) of initial attacks do occur in adults over 50 years of age.

ETIOLOGY OF GLOMERULONEPHRITIS

- **Strep Throat**
- **Systemic lupus erythematosus which is also called lupus**
- **Goodpasture Syndrome a rare autoimmune disease in which antibodies attack your kidneys and lungs**
- **Amyloidosis, which occurs when abnormal proteins that can cause harm build up in your organs and tissues**
- **Granulomatosis with Polyangiitis (formerly known as Wegener's granulomatosis), a rare disease that causes inflammation of the blood vessels**
- **Polyarteritis Nodosa a disease in which cells attack arteries**

CLINICAL SYMPTOMS

- **Proteinuria**
- **Haematuria**
- **Oedema**
- **Anorexia**
- **Shortness of breath**
- **Sodium and water retention**
- **Circulatory Congestion**
- **Tachycardia and elevated blood pressure**
- **Oliguria/ Anuria**

NUTRITIONAL MANAGEMENT

➤ **The major objective of dietary modification are:**

- **To Spare the diseased kidney**
- **To Prevent Uremia**
- **To Prevent Oedema**
- **To maintain adequate Nutrition**

PRINCIPLE OF DIETARY MANAGEMENT

High Calorie, Low Protein Moderate fat, Low Sodium, Low phosphate, Low potassium and low fluid diet is recommended for the patients with Glomerulonephritis.

Adequate protein is given ,unless oliguria or anuria develops.

Salt is not restricted unless there is oedema, hypertension or oliguria.

Fluid intake is adjusted to the total fluid output (i.e urine, vomiting, diarrhea)

Bed rest and antibiotic therapy are mainly important. Dietary modification are thus , not strict or rigid

ENERGY

- **For children** – 80 kcal/kg body weight and 10 % is increased in case of infection.
- Energy requirement for adult should be given according to age , sex and body weight and in case of infection 10 % of energy requirement should be increased.
- Energy requirement should be completed without increasing protein intake by means of sugar, honey, glucose, sago, fats and oils and starchy foods.

PROTEIN

- **If the blood urea nitrogen (BUN) is elevated and oliguria is present then dietary protein should be restricted.**
 - **For older children- 0.5gm/kg body weight**
 - **For younger children- 1 to 1.5 gm/Kg body weight/ day.**
 - **For adults 0.5 to 0.6 gm/kg body weight / day is recommended**
- **High Biological value protein should be given in diet.**
- **An intake of 20 to 40 gm protein per day is considered to be sufficient.**
- **Poor quality protein should be restricted.**

FAT

- **There is no need to restrict fat in diet.**
- **Inclusion of emulsified fat and easily digestible fat in the diet will provide non protein calories for energy needs, reduces the bulk of the diet as well as make the diet more palatable**

• **SODIUM**

Sodium restriction will vary upon degree of hypertension and oliguria.

If renal function is impaired then sodium will be restricted to 500mg to 100mg/day .

Sodium is restricted in case of oedema.

In sodium restriction following food should be avoided:

Salt during cooking or on the table

Food with Baking powder and soda bicarbonate , Sodium benzoate, potassium metabisulphite should be restricted.

Commercial soft drinks should be avoided.

POTASSIUM

When Kidney do not work properly , Potassium is builds up the body and leads to hyperkalemia.

Proper monitoring of potassium should be done through biochemical reports.

Hyperkalemia causes the heart beat unevenly and stops suddenly which result in cardiac arrest.

Food choices should be made according to potassium content of food items. Potassium is found naturally in almost all food especially in fruits and vegetables. Potassium content can be reduced by blanching them or cooking in excess water and then discard the water.

PHOSPHORUS

- **Eating high phosphorus containing food can lead to hyperphosphatemia.**
- **Meanwhile if calcium and vitamin D intake is also low, then it may lead to hypocalcaemia, hypoparathyroidism and kidney failure**
- **Hence low phosphate food with balanced calcium and vitamin D supplement is recommended in Glomerulonephritis.**

FLUID

Total Fluid intake = Total Urinary output + insensible water loss (500 ml/day)

FOOD INCLUDED: Rice, Sugar, leached vegetables, Sago , honey.

FOOD TO BE RESTRICTED: Milk, Jagggery, Pulses, Fruits like Pineapple, Banana, Papaya, watermelon etc.

FOOD TO BE AVOIDED: Salts, Green vegetables rich in Sodium like Amaranth, Bakery Product, Pulses, Fruits like Banana, Mango, Amla, Plums, Spota, Lemon, Peaches, Meat, Chicken and Eggs.