# Renal failure

# Definition

- Acute renal failure (ARF) is defined as an abrupt and significant decrease in GFR or / and in tubular function.

- Oliguric failure
  - < 1ml/kg/h in neonates and
  - < 0,5 ml/kg/h in other children)
- Non-oliguric failure

- Waste products (urea and phosphate) and water cannot be excreted sufficiently

# Kidney failure may be acute or chronic.

- Acute diseases
  - develop quickly and can be lethal
  - usually last for only a short time and then the kidneys recover (often in pre-renal causes)

- Chronic diseases
  - progressive
  - Not self limiting

# Age and kidney failure

- From birth to age 4 years, birth defects and hereditary diseases are by far the leading causes of kidney failure.
- Between ages 5 and 14 years, hereditary diseases continue to be the most common causes, followed closely by glomerular diseases.
- In the 15 to 19 year old age group glomerular diseases are the leading cause
- In adults chronic infections (Pyelonephritis, TB) play a major role

# Causes of kidney failure

Pre-renal:

- Tubular necrosis following:
  - blood loss,
  - septic shock,
  - hypotension,
  - severe dehydration,
  - poisoning

# Causes of kidney failure

**Renal:**

- Congenital diseases.
  - Congenital abnormal kidneys or babies born without kidneys (Potter Disease)
  - In polycystic kidney disease (PKD), children inherit defective genes that cause the kidneys to develop many cysts that replace healthy tissue
  - In Alport syndrome, the defective gene that causes kidney disease may also cause hearing or vision loss
- Hemolytic uremic syndrome
- Glomerulonephritis,
- Chronic pyelonephritis
- Vascular disorders (thrombosis of renal vein etc.)
- [illegible]oglobinuria in malaria!)

# Causes of kidney failure

Post-renal

- Hydronephrosis
  - Obstruction of ureter
  - Obstruction of urethra
  - Calculi
- Reflux
  - Chronic infection
  - Ureterocele
- Neurogenic bladder (spina bifida)

# Causes of kidney failure

**Systemic diseases**

- In Systemic Lupus Erythromatosis, an auto - immune disease.
- Diabetes leads to high levels of blood glucose that damage the glomeruli
  - Diabetes is the leading cause of kidney failure in adults but not in children.

# Hemolytic uremic syndrome: HUS

- Rare disease, mostly in children under 4 years of age
- Often a consequence of acute GE due to E. coli or other germs. Poisons produced by the bacteria (verotoxins) damage the kidneys.
- HUS has been observed also with other diseases (HIV, tumours, lupus)
- 7-10 days after initial disease the child remains listless and pale.
- Hemolytic anemia and hypertension develop
- Hematuria and proteinuria is present
- Urea and creatinine increase

# Treatment of HUS

- Due to hemolysis children with HUS may need blood transfusion
- Dialysis for a short time.
- Most children return to normal after a few weeks.
- Only a small percentage of children (mostly those who have severe acute kidney disease) will develop chronic kidney disease.

# Glomerulonephritis

- Familiar GN
  - Benign hematuria
  - Alport syndrom (chronic)
- Post infectious GN  (mostly acute GN)
- Idiopathic GN (often chronic GN)
- Systemic GN (Hep B, lupus)

# Post infectious GN

- Immune reaction 1-3 weeks after β hemolytic stretococcus infection

- Main symptoms:
  - Hypo- or Anuria
  - **Heamaturia**
  - Proteinuria
  - **Hypertension**
  - Oedema
  - **Increased Creatinine and urea**
  - Signs of heart failure may develop

# Post infectious GN

**Treatment**

- X-penicillin to eradicate all streptokocci
- Symptomatic treatment of high blood pressure and heart failure
- May need dialysis
- Corticoide and cytostatics not effective.
- Most often self limiting disease

# Clinical picture in renal failure

In acute failure:

- Poor general condition
- Oedema or dehydration
- Signs of precipitating disease

In chronic failure

- Anemia: pale, greyish skin
- Growth failure
- Renal osteopathy

# Diagnose of renal failure

- urinalysis / Urine microscopy: often hematuria, casts, protein ↑

**Blood serium**

- Urea and creatinine ↑
- Electrolytes e.g. Potassium ↑,Hyperphosphatemia
- Acidosis
- Urine output (reduced, but can be normal!)
- Glomerula filtration rate
  GFR = Creatinine concentration in urine x amount of urine in ml/h divided by plasma concentration of creatinin)
- Ultrasound
- Urethro-Cystogram, iv Pyelogram, renal biopsie

# Treatment

## Conservative Treatment

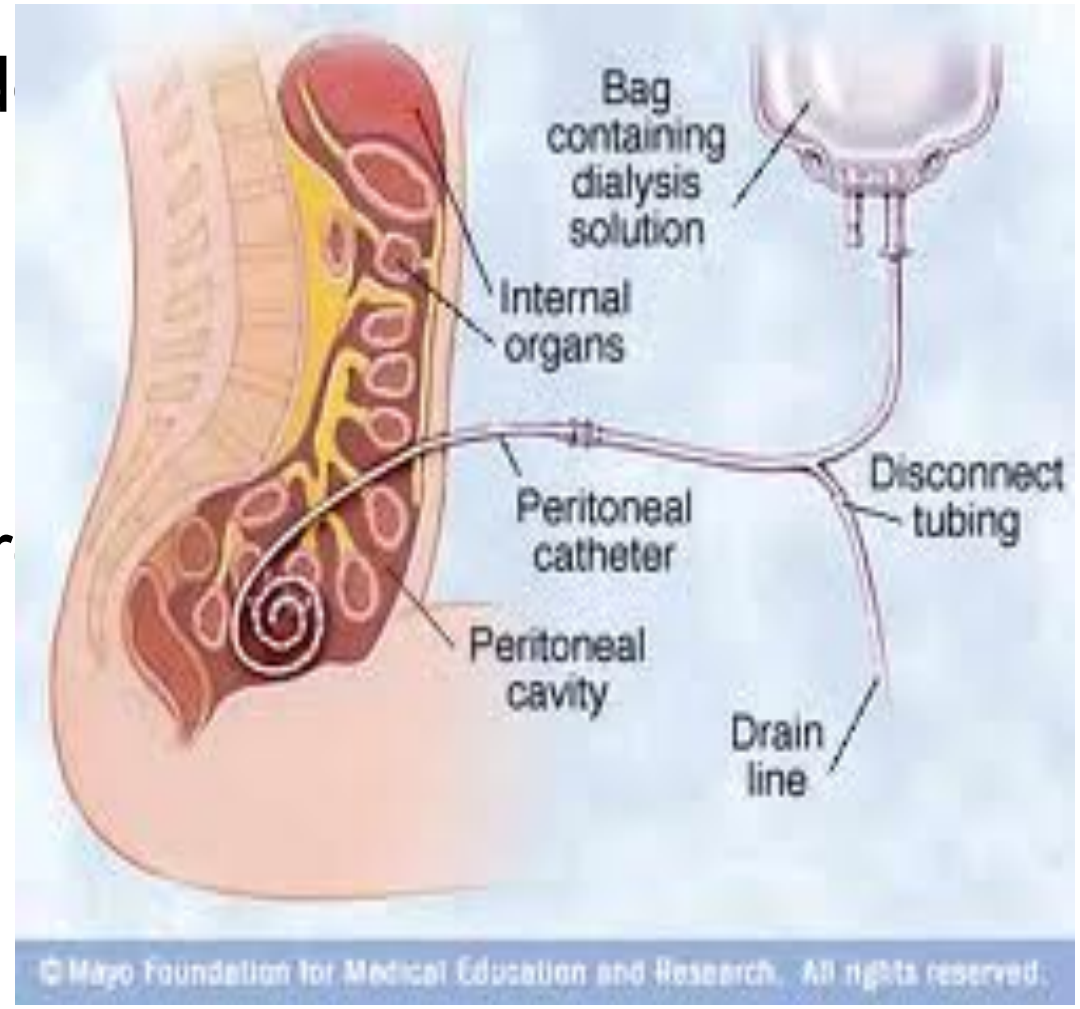
- Diet low in Potassium
- Water
  - Restriction of sodium and water (if oedematous)
  - Plenty of water if no oedema

# Dialysis and transplantation

- In complete failure conservative treatment is not successful
- Dialysis is necessary to remove the waste products and extra water from the blood
- The two main types of dialysis are
  - peritoneal dialysis and
  - hemodialysis.

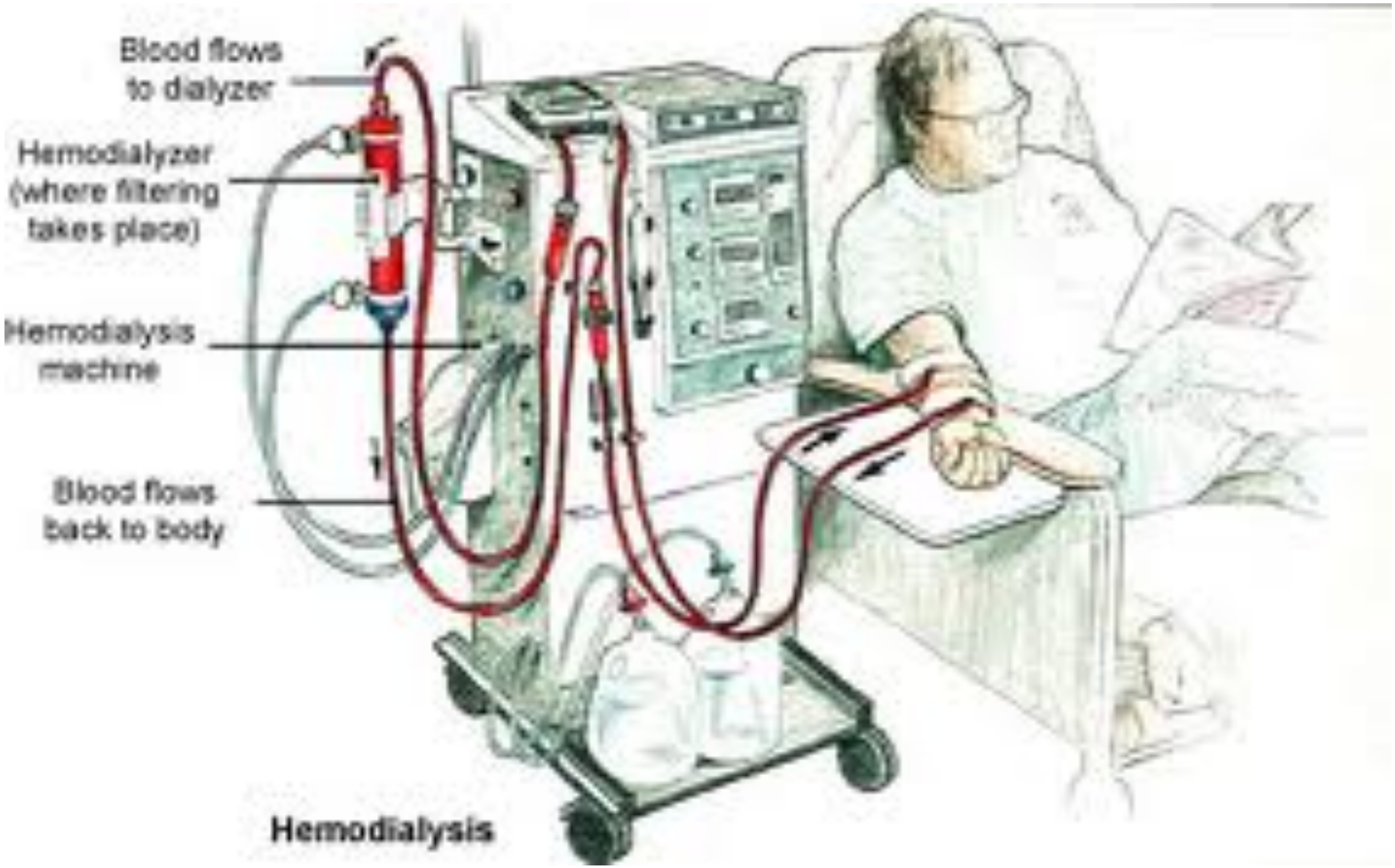
# Peritoneal dialysis.

- Pertoneal dialysis uses the peritoneum, as a filter.
- A catheter placed in the child's abd is used to pour a solution containing dextrose and electrolytes into the abdominal cavity.
- While the solution is there, toxic substances and extra fluid are filter into it from the blood.
- Later, the solution is drained from the abdomen, along with the wastes and extra fluid.
- The cavity is then refilled, and the cleaning process continues.



# Hemodialysis

- Hemodialysis uses a machine that carries the child's blood through a tube to a dialyzer, a canister that contains thousands of fibers that filter out the wastes and extra fluid.
- The cleaned blood is then returned to the child through a different tube.
- Hemodialysis is usually performed in a clinic under the supervision of a nurse and kidney specialist.
- It is generally required three times a week for hours each time.

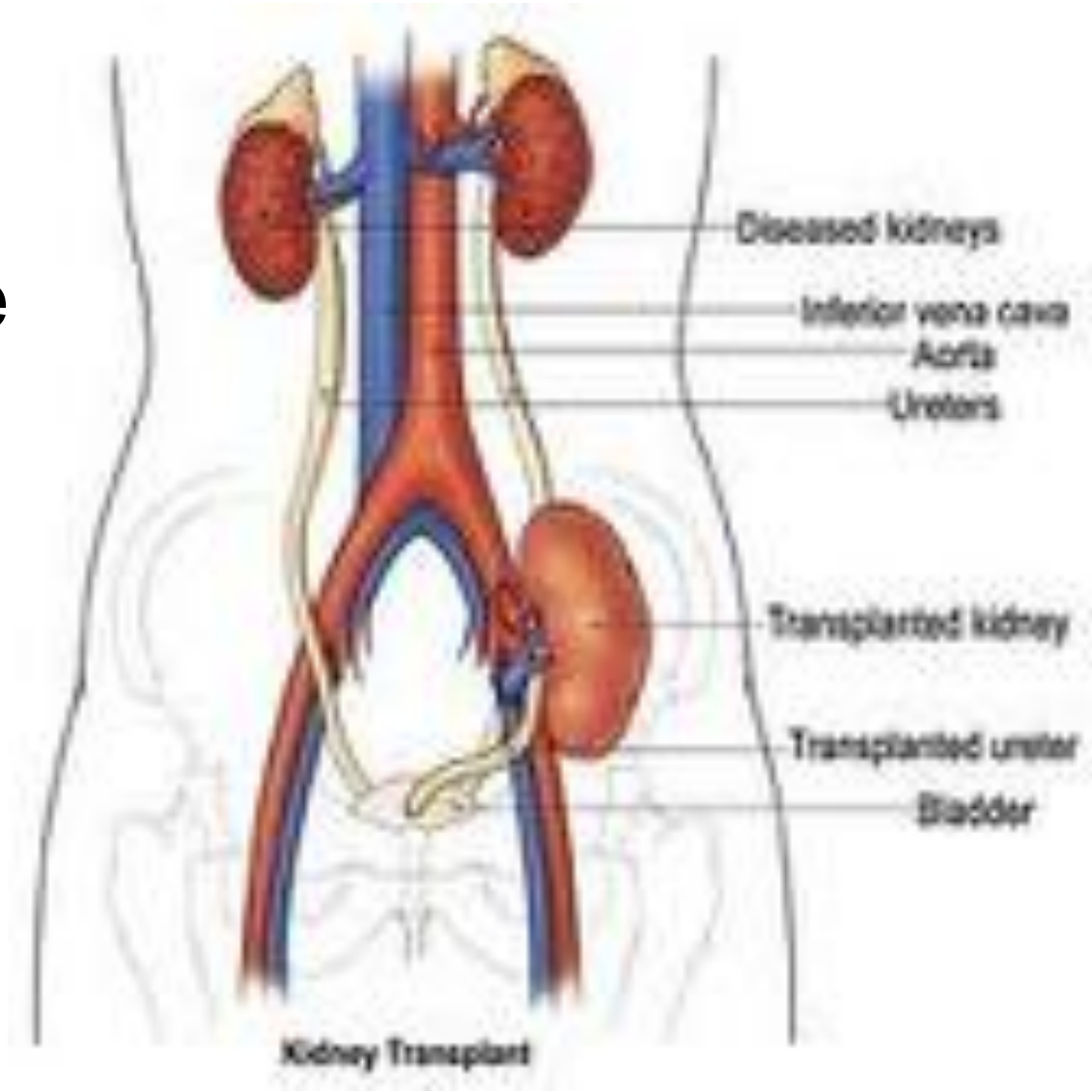

Blood flows
to dialyzer
Hemodialyzer
(where filtering
takes place)
Hemodialysis
machine
Blood flows
back to body
Hemodialysis

# Transplantation

- Transplantation provides the closest thing to a cure for kidney failure.
- The kidney may come either from a living donor or from someone who has just died.
  - Living donor. Many children receive a kidney from one of their parents, but the donor does not have to be a family member.
  - Deceased donor. If no living donors are available, a child may be placed on a waiting list to receive a kidney from someone who has just died.
    The United Network for Organ Sharing (UNOS) maintains a computerized system for matching kidneys with appropriate recipients.

# Transplantation

- People who have transplants must take immune suppressive drugs to keep the body's immune system from rejecting the new organ.
- A good function in the transplanted kidney can be maintained for many years.
- However, the drugs have some undesirable side effects such as reducing the child's immunity.



Thank you