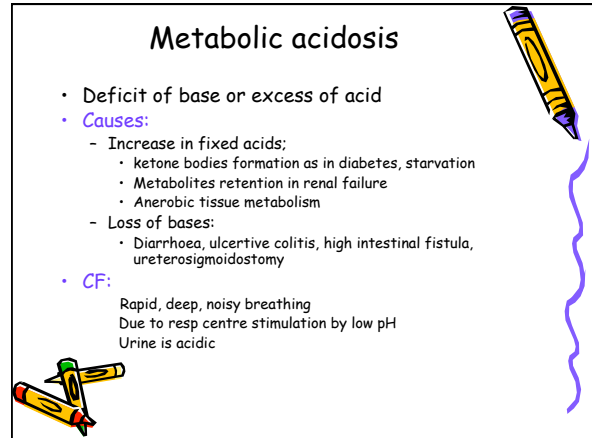


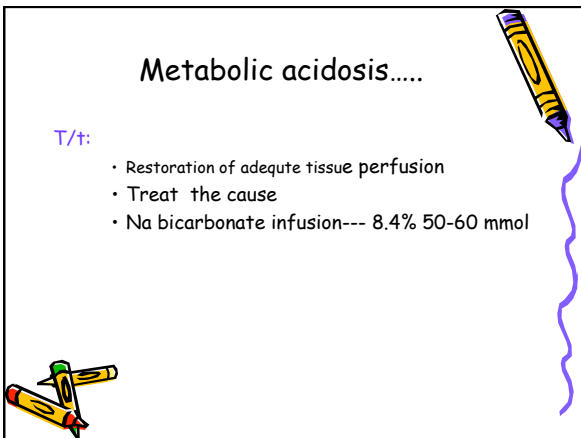
Acid-base balance.....

26th May 2011



Metabolic acidosis

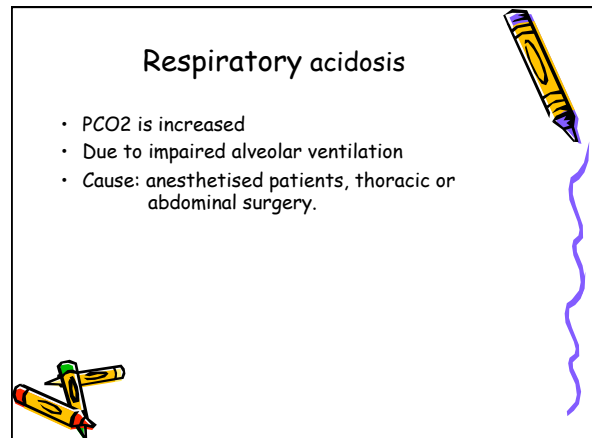
- Deficit of base or excess of acid
- **Causes:**
 - Increase in fixed acids;
 - ketone bodies formation as in diabetes, starvation
 - Metabolites retention in renal failure
 - Anaerobic tissue metabolism
 - Loss of bases:
 - Diarrhoea, ulcerative colitis, high intestinal fistula, ureterosigmoidostomy
- **CF:**
 - Rapid, deep, noisy breathing
 - Due to resp centre stimulation by low pH
 - Urine is acidic



Metabolic acidosis.....

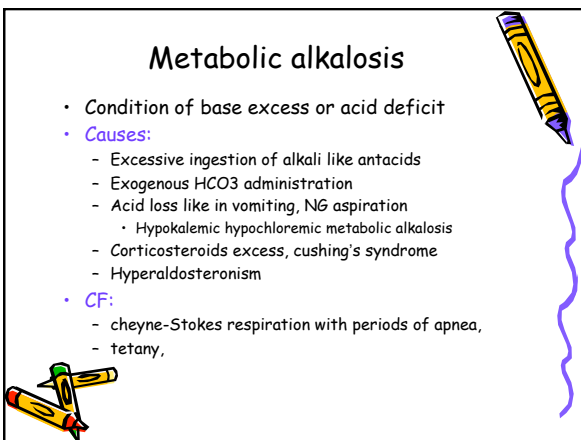
T/t:

- Restoration of adequate tissue perfusion
- Treat the cause
- Na bicarbonate infusion--- 8.4% 50-60 mmol



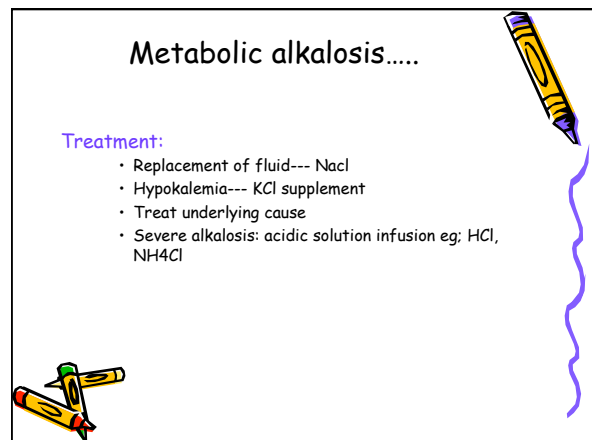
Respiratory acidosis

- PCO₂ is increased
- Due to impaired alveolar ventilation
- Cause: anaesthetised patients, thoracic or abdominal surgery.



Metabolic alkalosis

- Condition of base excess or acid deficit
- **Causes:**
 - Excessive ingestion of alkali like antacids
 - Exogenous HCO₃ administration
 - Acid loss like in vomiting, NG aspiration
 - Hypokalemic hypochloremic metabolic alkalosis
 - Corticosteroids excess, Cushing's syndrome
 - Hyperaldosteronism
- **CF:**
 - Cheyne-Stokes respiration with periods of apnea,
 - tetany,



Metabolic alkalosis.....


Treatment:

- Replacement of fluid--- NaCl
- Hypokalemia--- KCl supplement
- Treat underlying cause
- Severe alkalosis: acidic solution infusion eg: HCl, NH₄Cl

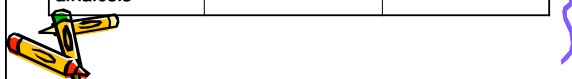
Respiratory alkalosis

- PCO2 decreased
- Cause:
 - Excessive pulmonary ventilation
 - Hyperventilation--- high altitude, hyperpyrexia

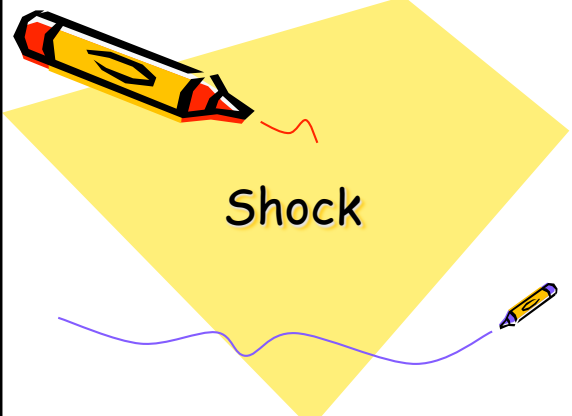
T/t: correct underlying cause.



Disorder	Initial change	Compensatory response
Metabolic acidosis	HCO3 decrease	PCO2 decrease
Metabolic alkalosis	HCO3 increase	PCO2 increase
Respiratory acidosis	PCO2 increase	HCO3 increase
Respiratory alkalosis	PCO2 decrease	HCO3 decrease




Shock



Defn

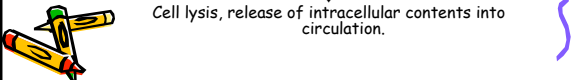
- A systemic state of low tissue perfusion which is inadequate for normal cellular respiration.
- One of the most common cause of death among surgical patients.
- Death--- early: profound state of shock
delayed: consequences of organ ischemia & reperfusion injury



Pathophysiology

1. Cellular:

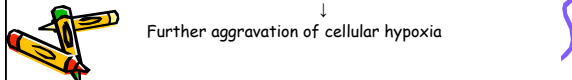
- Less O2 & glucose → aerobic to anaerobic metabolism
 - ↓
 - Lactic acid production
 - ↓
 - Systemic metabolic acidosis
- Glucose pool exhausted → anerobic respiration ceases
 - ↓
 - Failure of Na-K pump
 - ↓
 - Autodigested enzymes released from lysozymes
 - ↓
 - Cell lysis, release of intracellular contents into circulation.



Pathophysiology...

2. Microvascular:


- tissue ischemia
- ↓
- Activation of immune & coagulation system, complement activation, neutrophil priming
- ↓
- Capillary endothelial injury
- ↓
- Leaking through endothelial cells
- ↓
- Tissue edema
- ↓
- Further aggravation of cellular hypoxia



Pathophysiology...


3. Systemic:

- **Cardiovascular:** tachycardia & vasoconstriction
- **Respiratory:** tachypnea, increased minute volume
↓
Compensatory respiratory alkalosis
- **Renal:** decreased perfusion pressure-----decreased
glomerular pressure----- decreased
urine output
RAA activation----- vasoconstriction, Na & H₂O
reabsorption
- **Endocrine:** adrenaline, RAA, ADH, Cortisol




Ischemia-reperfusion syndrome

- Tissue hypoxia, cellular inflammation---- Anerobic metabolism-----acid, K, toxic metabolites accumulation.
- Once normal circulation restored----- metabolites released into circulation----direct myocardial depression, vascular dilatation, endothelial injury, ----acute renal injury, acute lung injury, multi organ failure & death.
- Thus best way--- reduce extent & duration of hypo perfusion.




Classification

- Hypovolemic
- Cardiogenic
- Obstructive
- Distributive
- Endocrine




Hypovolemic shock

- Most common
- Reduced circulatory volume
- Causes: hemorrhagic, poor fluid intake, excessive fluid loss, 3rd space loss




Cardiogenic shock

- Failure of heart to pump blood to the tissues.
- Causes: MI, arrhythmia, VHD, cardiomyopathy, cardiac injury, myocardial depression like in sepsis or drug.



Obstructive shock

- Mechanical obstruction of cardiac filling----- reduction of preload--- ↓cardiac output.
- Causes: cardiac tamponade, tension pneumothorax, pulmonary embolism, air embolism,



Distributive shock

- Vascular dilatation with hypotension, low systemic vascular resistance, inadequate afterload.
- High cardiac output
- Causes: septic shock, anaphylaxis, spinal cord injury (neurogenic shock)



Endocrine shock

- Represent combination of hypovolemic, cardiogenic & distributive shock
- Causes: hypo/hyperthyroidism, adrenal insufficiency,



Severity of shock

- **Compensated shock:**
 - Blood flow to kidney, brain, lungs maintained but reduced to skin, muscle, intestine.
 - Occult hypoperfusion if prolonged may lead to MOF.
- **Decompensated:**
 - If further loss of circulating volume persists.
 - Blood loss > 30-40 % volume is decompensated.
 - Mild, moderate, severe shock

