Pediatrics Clinical Chemistry

Clinical Chemistry of newborn

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Clinical chemistry of newborn

The survival rate of very small premature infants has increased because of improved specialized medical and nursing techniques for treating the newborn

The communist disorders are

1) Respiratory disorder
2) Infection

Biochemical investigation requested in neonatal period as in adults, but requesting is less selecting because of

1) Non –specific of the presenting clinical signs
2) Inability of the infant to give history.
3) The number of tests is limited by the small volume of samples.

- Because blood volume of a premature weighing 1kgm is about 90 ml compared with that of an adult weighing 70 k gm ,only a small amount of blood can be taken without causing volume depletion on anemia venous (or arterial) blood samples although some times are ,since the later causes contamination from inters shill fluid and cellular fluid .

Renal function

- Renal function is not fully developed will the age of about two, glomerular function develop move rapidly them that of the tubule
- **Plasma creatinine**:
- Which is reversely related is (GFR) glomerulor filtration rate is higher at birth than in adult .

Plasma urea

- is low in newborn infants compared with that of adult ,despite the relatively low (GFR),the high anabolic rate results in more nitrogen being used for protein synthesis rather than in the urea formation as in adult .
- Neither plasma creatinine or urea conc . are sensitive indicators unless tests performed serially Renal function is often difficult to assess in the newborn period

Water and electrolyte

- About 80% of an infant of less than1 Kgm consist of water, compared with100% of an adult.
- Water loss in infants much higher than in adults because
- 1) More fluid is last through skin because the epidermis is not fully developed before about 28 weeks.
- 2) There is high metabolic and respiratory rate.
- Daly fluid requirements are therefore up to five times higher per kgm body weight than in adults.

Sodium:

- The total body sodium and the plasma sodium conc, fluctuate because renal function is immature the newborn unlike adult is unable to make its need for water clean. The plasma conc . Should be monitored to ensure that the proportion of sodium to water is correct, otherwise the changes may caues convulsion or even coma .

Kalaemia :Potassium

- **Hypokalaemia** may be caused by increased diarrhea
- **Hyperkalaemia** caused by glomerular dysfunction and tissue damage due to hypo oxgen.
- perinatal asphyxia
- Renal complication and disturbances of electrolyte balance are likely to develop in infants with perinatal asphyxia.

Bilirubin:

- More conjugated bilirubin reaches the liver in the newborn infant than in adults because
- 1) R.B. Cs life is shorter.
- 2)Bruises may occur during birth and hemoglobin break down product increases the plasma bilirubin
- 3)in newborn the conjugated process is not fully developed .the increase load cause jaundice

Physiological jaundice:

- Is defined an mild jaundice which is not present at birth and develops during the first few days and continues during the first week of life ,with on obvious pathological reasons , plasma unconjugated bilirubin conc may be very high in premature infants because of hepatic immaturity .
- If the bilirubin conc .exceeds the albumin capacity, the unbound, fat soluble unconjugated bilirubin may cross cell membranes and be deposited in the brain, this is a serious complication, which may caves brain damage or death.
- Jaundice during the 24 hours of life is physiological rather than pathological.

Causes:

1) ABO blood group incompatibility.
2) Inherited erythrocyte abnormalities associated with hemolysed, Glucose -6-phosphate dehydrogenises deficiency
3) Inter uterine infections .syphilis, rubella or toxoplasmosis

Management:

1- blood transferees

2- Bilirubin destroyed with UV light

3-water loss balanced by fluid

Glucose metabolism

Infants may become hypoglycemic because infants have very little liver glycogen full term infants may become hypoglycemic if initially adequate stores are drawn more rapidly than normal e.g during prenatal aspheric.

Plasma conc. Of glucose low as 30 mg/dl during the 1st 72 hours and later become 40 mg/dl impaired neurological development happen if plasma glucose less than 40mg/dl

Protein is lower in infants than adults

TSH- rise due to birth stress

Cardiac Function

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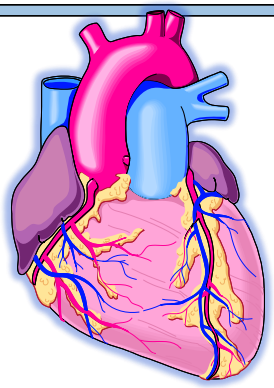
The Heart & Functions

- The **heart** is a muscular organ responsible for pumping blood through the blood vessels by repeated, rhythmic contractions.
- Size of human fist
- Weighs 250-350 g



- The primary **function** of the heart is to pump blood in order to generate and sustain an arterial blood pressure necessary to provide adequate perfusion of organs.

Common Symptoms of Heart Disease

- Dyspnea ضيق التنفس
- Chest pain
- Cyanosis الزرقة
- Palpitations الخفقان
- Fatigue التعب
- Edema

Heart Diseases

- **1-Congenital heart disease** **or Congenital Cardiovascular Defects (CCVDs)**
  - Abnormalities arising from the abnormal formation of the heart or its major blood vessels
- **2-Congestive heart failure**
- clinical syndrome that results from any disorder that impairs the ability of the ventricle to fill with or eject blood
- **3-Hypertensive heart disease**
  - a general term used to describe heart diseases caused by direct or indirect effects of elevated BP
  - Hypertension is defined as persistent systolic blood pressure (BP) of at least 140 mm Hg and/or diastolic pressure of at least 90 mm Hg

Heart Diseases

- **4-Acute Coronary Syndromes**
  - a general term used to describe the following series of events:
    - **Angina** (الذبحة الصدرية), reversible tissue injury, myocardial infarction (MI), and extensive tissue necrosis.
  - The major cause of ACS is **atherosclerosis**

Role of Laboratory

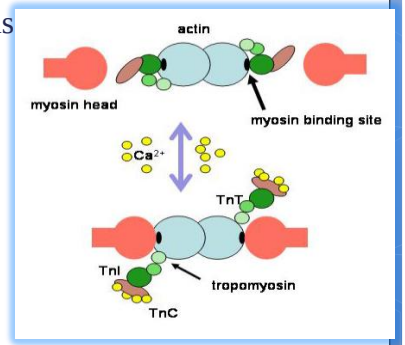
- This is performed through analysis of body chemistry metabolites, such as:
- **1-Lipid profile test**
  - total cholesterol,
  - high-density lipoprotein
  - cholesterol,
  - high-sensitivity C-reactive protein.
- Risk factor assessment enables health-care professionals to educate the patient and to start activities that will reduce risk for an AMI.

Laboratory Diagnosis of AMI

- **2-Enzymes**
  - **Creatine kinase "CK"**
    - Involved in the transfer of energy in muscle metabolism.
    - **3-Myoglobin**
    - It starts to rise within 2-4 h and is detectable in all AMI patients between 6-9 h from chest pain onset.

Cardiac Proteins

- **4-Troponin**
  - The preferred biomarkers for assessment of myocardial necrosis
  - The major function of troponins is to bind calcium and regulate muscle contraction.



Case Study

- Joe is an overweight 57-year-old male who was mowing his lawn when he experienced a sharp chest pain along with pain in his left arm.
- His wife rushed him to the hospital, fearing that he was having a heart attack.
- In the clinic, the physician examined Joe and sent him for **electrocardiogram (ECG)** and blood work.
- The blood is processed in the clinical laboratory and the serum is tested for troponins, creatine kinase (CK), and creatine kinase isoenzyme MB (CK-MB).

Test	Joe	Reference Ranges
Troponin I (ng/mL)	1.7	0.0–0.05
CK-MB (%)	7	<3.9
CK (IU/L)	275	46–171

Comment

- All of these cardiac biomarkers are elevated.
- There is a high likelihood that Joe had a myocardial infarction.
- These results, combined with ECG, history, and physical examination, were used to make the diagnosis of AMI.