CLINICAL BIOCHEMISTRY

CLINICAL ANALYSIS;

Diagnosis of disease

Monitoring patient

Scaning for disease (phenylketonuria, cancer)

Biological materials:

- *Blood
- *Urine
- *Feces
- *Spinal fluid, sweat, body fluids

Normal/Abnormal values:

1-If the analysis is performed for the first time, the result is normal / abnormal?

2- What is the importance of abnormal result for diagnosis?

3- What is the importance of only one test in a group?

Reference values:

Values outside a normal range as a test result may be abnormal but insignificant. On the other hand, a result within a normal range of a certain disease may also be abnormal. (such as the appearance of normal Hb levels in a person with chronic obstructive respiratory disease).

* Normal or abnormal?

Na, K, Glucose don't differ among populations.

Some parameters such as lipids may differ among populations.

Factors effect test results:

Cause	Effected variable:
Age	ALP, urate
Sex	Steroids, creatinine
Ethnicity, exercise	CK
Pregnancy	Urea
Posture	Proteins
Stress	Prolactin
Nutrition	Glucose
Time	Cortisol
Drugs	Varies for every test

Examples:

•In new borns, glucose is guickly metabolised because of the high number of erythrocytes.

•In addition, in new-borns, bilirubine levels are high due to the immaturity of liver.

•In adolescence, ALP and creatinine levels increase due to the increase in bone and muscle mass.

•ALP levels begin to fall after age 12 in girls whereas after age 14 in boys.

•Albumin leves fall down in every 10 year after age 60.

•In geriatric patients, calcium levels also decrease due to decreased albumin.

•Anemia in geriatric patients is partly due to decreased acidity of the HCL. HCL is required for iron absorption.

•In addition, in the elderly, atrophy of the stomach leads to the decrease in intrensec factor and B12, which collectively result with anemia.

•Caffeine; tea, coffee, chocolate, carbonated beverages and energy drinks lead to the release of catecholamines.

•Consuming drinks or foods rich with caffeine results with increased gluconeogenesis and blood glucose.

Factors effect test results:

A- Before collecting biological material :

1- Diet

Vanilla ice cream (last 3 days): VMA in urine (fechromasitoma)

Tomato, banana, pineapple, eggplant, walnut, hazelnut, pistachio, avacado and (Seratonin) (last 72 hrs) : 5-OH indole derivatives in urine (GI system CA)

Caffeine; Fatty acids %30↑, blood sugar ↑

Alcohol; Uric acid ↑

Meat: Urea, urate ↑ (4 days later)

Herbal tea, herbal products

2- Cigarette

Trombocyteaggregation ↑, leukocytes ↑

3- Drugs

4- Menstruation: Creatinine, uric acid ↑

B- Evaluation of possible outcomes during collecting samples

Posture

In standing position the blood volume is 600-700 mL less than a person in supine position.

Plasma proteins and related substances increase by 10-13%. (Albumin, bilirubin, cholesterol, TG, Ca2 +)

Change to the upright position when lying down, change in 10 min,when you are standing and then lay down, the change is completed in 30 min.

Hospitalisation:

Long term resting: Water retention occurs, protein 0.5 g/dL ↓, albumin 0.3 g/dL ↓ , Ca ↓

*Venous stasis

Proteins and protein binding substances (Ca, bilirubine, fatty acids and drugs)

*Venes:

Arterial venes;
Venous venes;
Capillary blood;

*High fever :

Can effect various parameters icluding lipids, hormones, uric acid and calcium levels.

*Circadian rhytm

Serum Fe;	8.00	⟶ 14.00	% 50 ↓
Cortisol	8:00	⟶ 16:00	% 50 ↓
Serum K	8.00 de		5.4 mmol/L
	14.00 de		4.3 mmol/L

C- Endogenous factors interfering tests

Hemolysis, lipemi, high bilirubin

These factors may stem from various causes:

New borns, diabetic patients, geriatric patients, parentheral nutririon, etc….

High bilirubin levels may occur in hemolysed blood from new borns.

2 causes of hemolysis:

In vivo; enzyme defects, hemoglobinopathies, infections, autoimmune diseases, erythrocyte membrane defects

In vitro; mechanical, blood freezing, prolongation of the analysis period, centrifugation too fast etc

Erythrocytes are rich in LDH, AST, K, Mg. A massive hemolysis also leads to the release of erythrocyte plasma, and blood plasma and extracellular electrolytes; Na becomes diluted.

Because anticoagulants prevent in vitro hemolysis, plasma is preferred instead of serum; K +, is lower in plasma than in serum. Proteins are low in serum, high in plasma.

Hemolysis

1- Release of erythrocyte contents

Serum K, LDH, AST, total protein,
demir, amonyum, fosfat, K, Mg increase

Na decreases

2- Hb interference

In hemolysed serum, Hb, K and LDH are detected, if LDH and Hb are increased but K is normal, that means hemolysis stems from in vivo conditions.

Icteric serum:

Albumin, cholesterol, creatinine, protein?

Lipemic serum:

Causes: Ethanol, diabetes, hypothyroidism, cronical kidney failure, pancreatitis, cirrhosis, parenteral nutrition, steroids, some drugs such as estrogen.

High TAG level and blurriness of icteric serum interferes with the measurement of various parameters.

Albumin, Ca, amylase, urea, uric acid tests may be affected.

Grouping tests:

A- According to the tissue or disease:

For the heart: CPK, LDH, AST, ALT

For the liver: AST, ALT, BSP, Bilirubin, Alkaline Phosphatase

For pancreatitis: Urine amylase, serum amylase, Lipase, Trypsin, Ca

B- According to the laboratory:

Microbiology

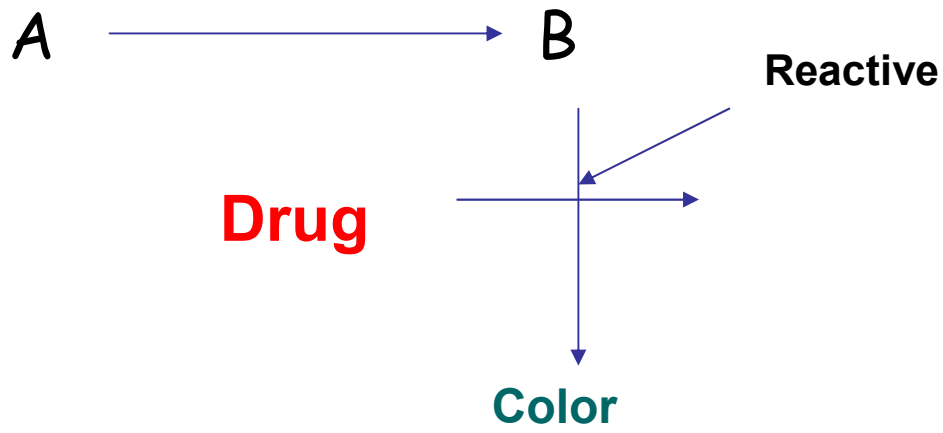
Hematology

Serology

Biochemistry

INTERPRETATION OF TESTS
DRUG INTERFERENCE

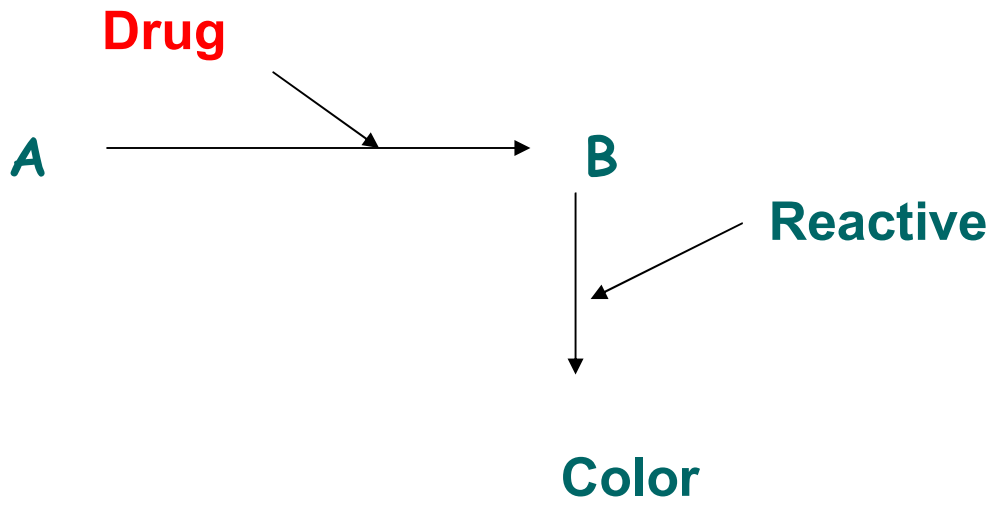
Chemical Intereference



False positive
False negative

*** Erythromycine causes false positive in serum transaminases**
*** High dose *Aspirin* causes false positive in urine glucose**
*** *C* vit causes false positive in urine glucose, *Clinitest*-gives false negative with glucosidase**

Pharmacological interference:



True positive
True negative

* hydrochlorothiazide diuretics increase serum uric acid levels
* Statins increase serum transaminases
* Paracetamol increase serum transaminases.
* Paracetamol increase serum uric acid levels.

In July 2011, the health authority in the United Kingdom (McNeil Consumer Healthcare) announced that it reduced the dose of Tylenol containing 500 mg paracetamol from a maximum of 4000 mg to 3000 mg in adults.

On the other hand, dose for children between the ages of 6-12 was classified in 3 groups: 6-8 years, 8-10 years and 10-12 years.

1-3 month old child dose for fever and pain
was declared as max 60 mg / kg

75-150 mg / kg / day (determined as toxic dose if> 150 mg / kg / day)

Paracetamol use over 3 days was declared to be acceptable with only doctor suggestion.