Clinical Biochemistry for Pharmacy

Introduction

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Ref. An illustrated colour text in clinical biochemistry, Gaw, 4th ed, 2008

CLINICAL BIOCHEMISTRY

- Clinical biochemistry, chemical pathology and clinical chemistry

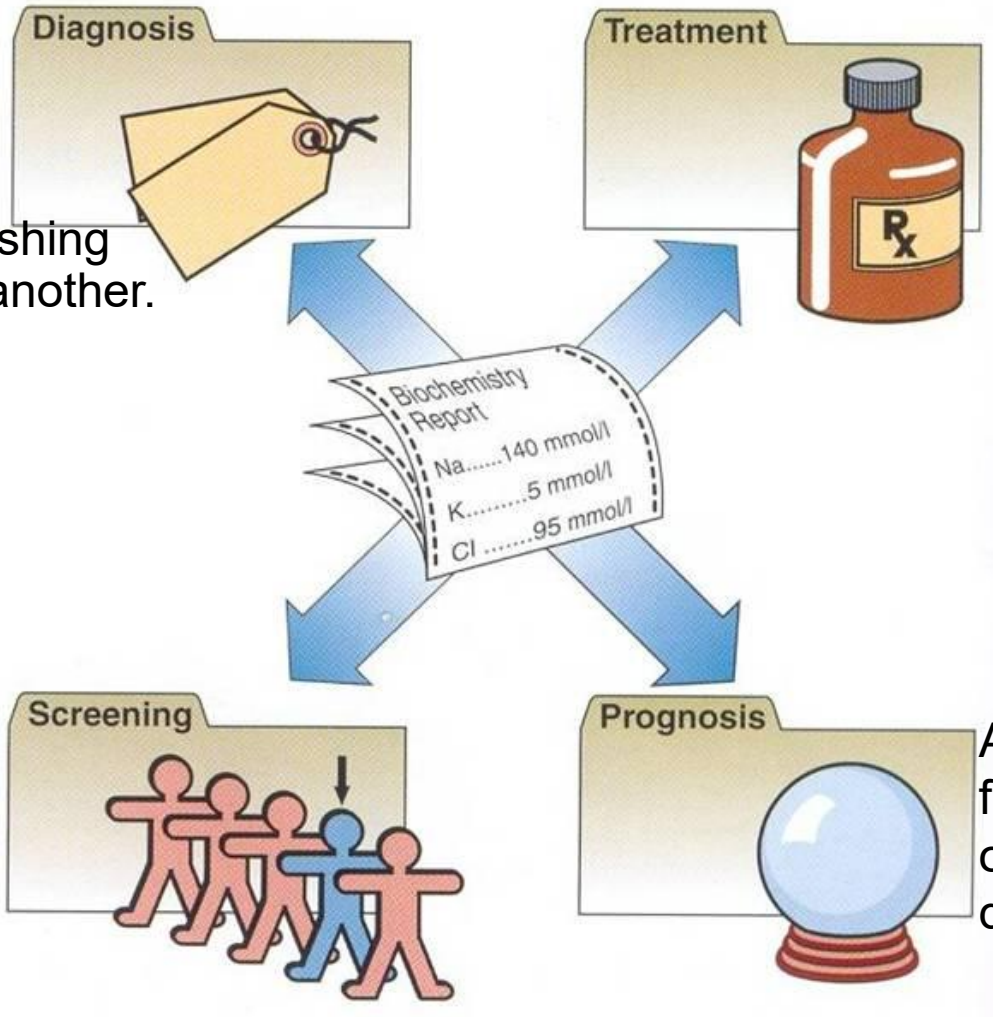
- The test must be performed as accurately as possible
- Biochemical tests are used extensively in medicine for both diagnosis and prognosis of diseases

- Your role as a **pharmacist** (*Terminology knowledge, understand basis of lab test, effect of disease and drugs on the diagnostic test*)

Biochemical tests

Qualitative and quantitative analysis

The art of distinguishing one disease from another.



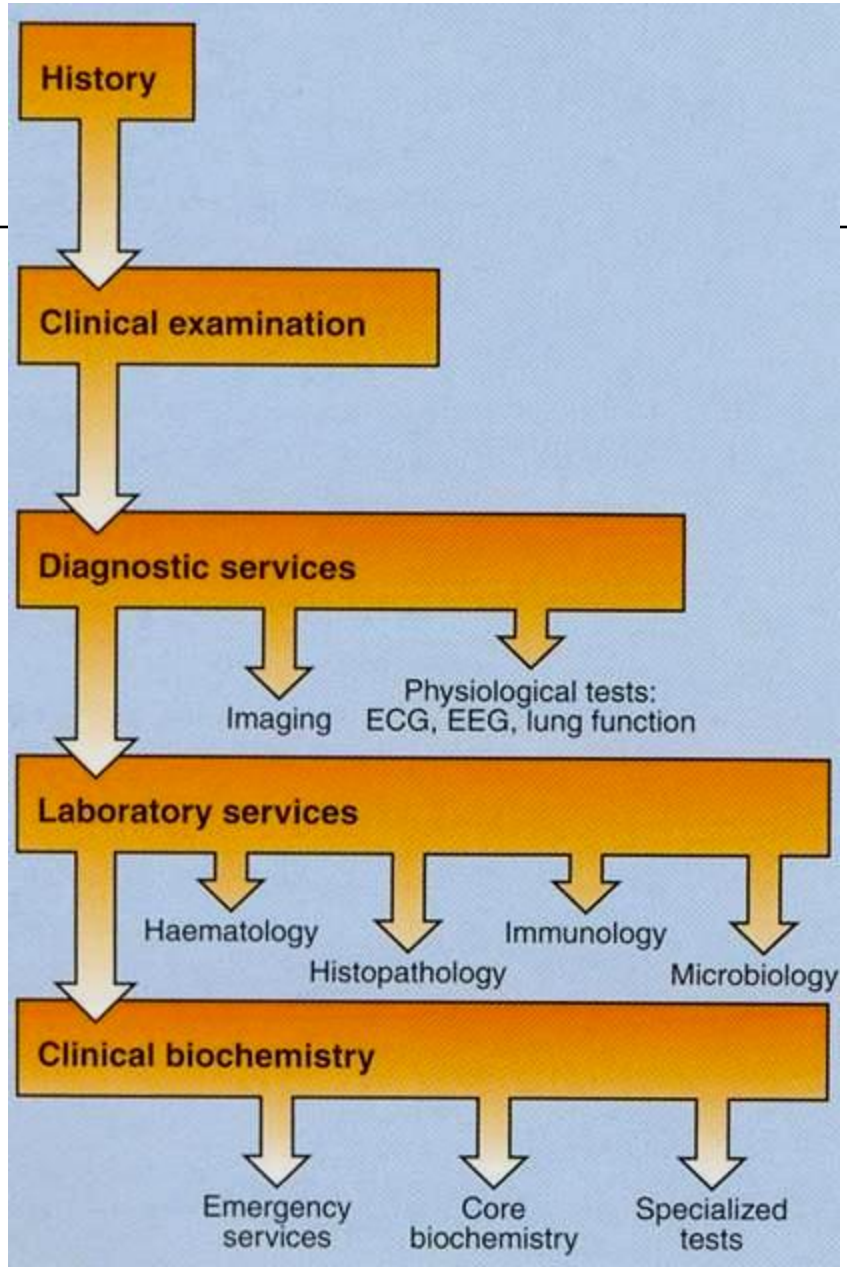
Monitoring: sequential recording, keep watch over analyte

Examine for the presence or absence of a disease.

An assessment of the future course and outcome of a patient's disease

The place of clinical biochemistry in medicine

Clinical biochemistry tests comprise over one-third of all hospital laboratory investigations



The clinical biochemistry tests

1. Core biochemical tests

Sodium, potassium, chloride and bicarbonate

Urea and creatinine

Calcium and phosphate

Total protein and albumin

Bilirubin and alkaline phosphatase

ALT and AST

γ-glutamyl transpeptidase

Creatinine kinase

H^+, PCO_2, and PO_2 (blood gases)

Glucose

Amylase

The clinical biochemistry tests

2. Specialized tests

Hormones

Specific proteins

Trace elements

Vitamins

Drugs

Lipids and lipoproteins

DNA analysis

3. Emergency tests

Urea and electrolytes

Blood gases

Amylase

Glucose

Salicylates

Paracetamol

Calcium

Importance of clinical chemistry

- A working knowledge of clinical chemistry and biochemistry is essential for the pharmacist to effectively communicate and interact with other health professionals.

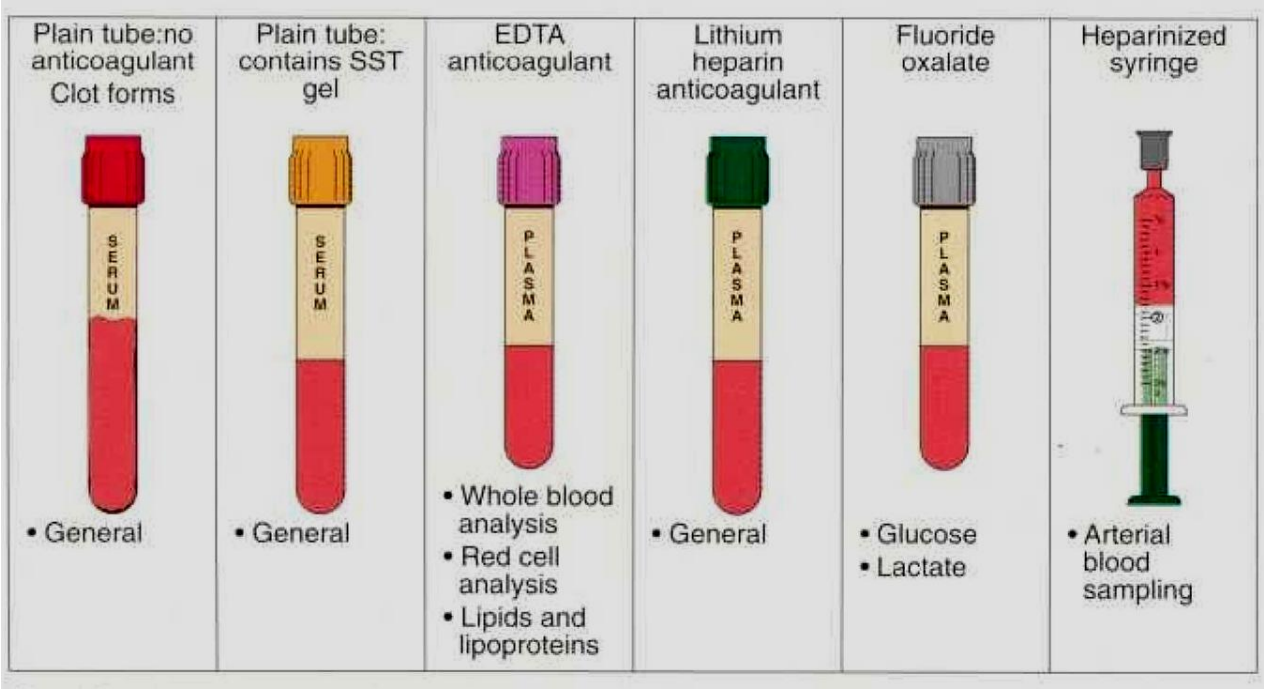
- This course provides the basic information in lab medicine that is necessary for the pharmacist.

Sample collection and processing

- **Specimens used for biochemical analysis:**

1. Venous blood, arterial blood, capillary blood
   serum vs plasma
2. Urine
3. Faeces
4. CSF
5. Sputum and saliva
6. Tissue and cells
7. Aspirates, e.g. pleural fluid, synovial fluid, intestinal, pancreatic pseudocytes
8. Calculi (stones)

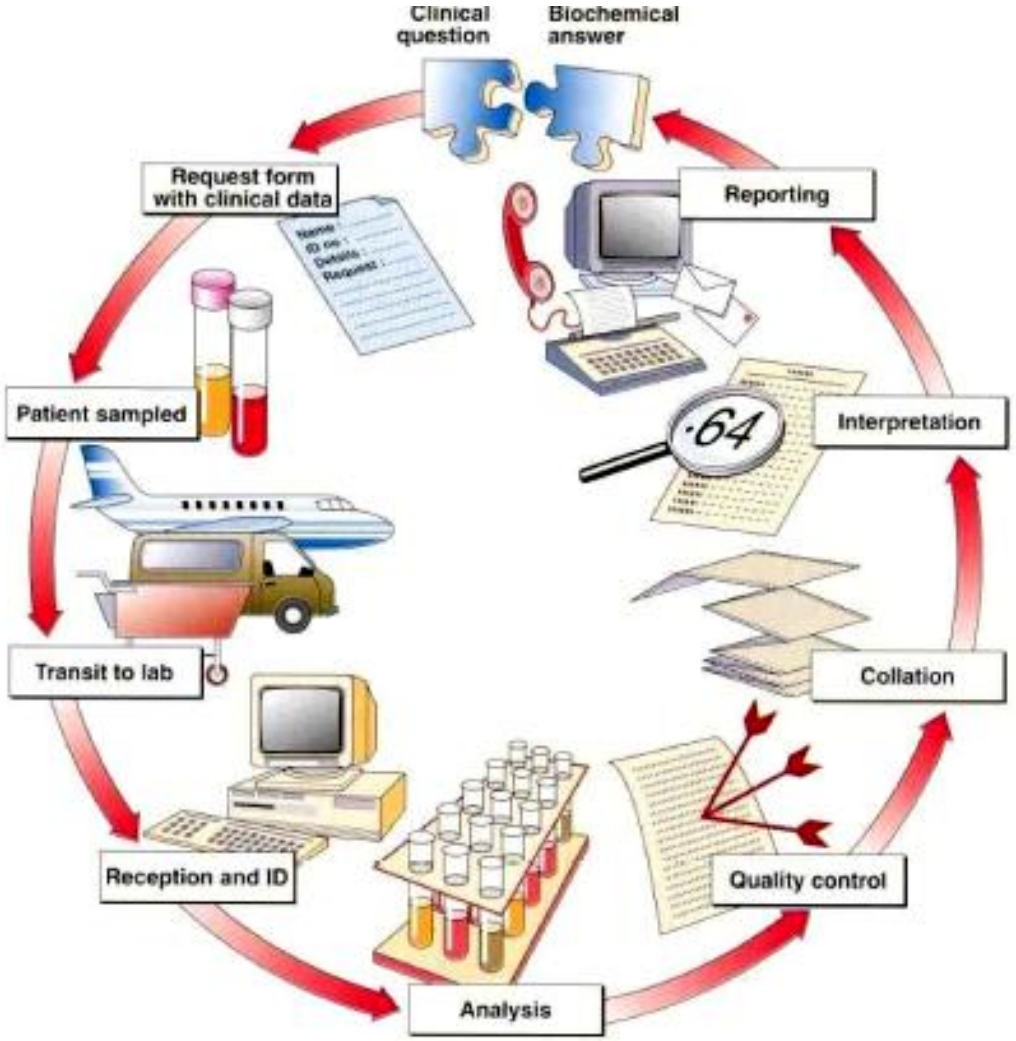
Types of containers used in the collection of blood specimens



Sampling errors

- Blood sampling technique
- Prolonged stasis during venopuncture
- Insufficient specimen
- Incorrect specimen container
- Inappropriate sampling site
- Incorrect specimen storage

Analysing the specimen



Interpretation of results

- Value obtained with a particular parameter is interpreted as increased, decreased or within normal (reference) range

- **Reference values:** Values obtained from individuals who are in good health as judged by other clinical and laboratory parameters, after suitable standardization and statistical analysis, under definite laboratory conditions.

- **Normal (Reference) Range:** Values within which 95% normal healthy person's fall. The cut off values are set as mean reference value +/- N times standard deviation, of a normal healthy population; where N varies between 1, 2 and 3.

Quality Control

- A major role of the clinical laboratory is the measurement of substances in body fluids or tissues. To fulfill these aims the data generated has to be **reliable** for which strict quality control has to be maintained.

- Quality control is defined as the study of those sources of variation, which are the responsibility of the laboratory, and the procedures used to recognize and minimize them.

- Quality control involves consideration of a reliable analytical method. Reliability of the selected method is determined by its accuracy, precision, specificity and sensitivity

Quality Control

- **Accuracy** has to do with how close the mean of a sufficiently large number of determinations on a sample is to the actual amount of substance present and is dependent on the methodology used.
- **Precision** refers to the extent to which repeated determination on an individual specimen vary using a particular technique and is dependent on how rigorously the methodology is followed.
- **Specificity** is the ability of an analytical method to determine solely the analyte it is required to measure.
- **Sensitivity** is the ability of an analytical method to detect small quantities of the measured analyte.

Quality Control

- Analytical methods **require calibration**, the process of relating the value indicated on the scale of the measuring device to the quantity required to be measured. Calibration is done using standard, the solution with which the sample is compared to arrive at the result.

- **Standard solutions** refer to the known amount of a substance in a solution in which its concentration is expressed in terms of moles or in weights per unit volume.

Biological factors affecting the interpretation of results

- Sex of the patient.
- Age of the patient.
- Effect of diet.
- Time when sample was taken.
- Stress and anxiety.
- Posture of the patient.
- Effects of exercise.
- Medical history.
- Pregnancy.
- Drug history.

Case history 1

A blood specimen was taken from a 65-year-old woman to check her serum potassium concentration as she had been on thiazide diuretics for some time. The GP left the specimen in his car and dropped it off at the laboratory on the way to the surgery the next morning.

Immediately on analysing the sample, the biochemist was on the phone to the GP. Why?

Comment on page 152.