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Special Senses Module

2nd Year MBBS(SKL)

Interpretation of Lab Reports

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Date: 26-02-25

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Motto, Vision, Dream

- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

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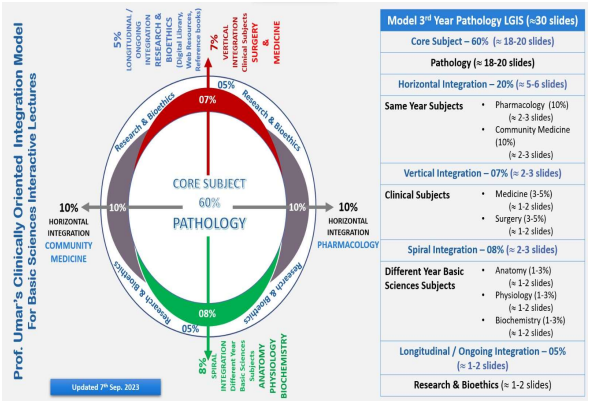
Professor Umar Model of Integrated Lecture



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Skill Lab Assessment

Question 1

A patient's complete blood count (CBC) shows:-

Hemoglobin (Hb): 10 g/dL-

Mean Corpuscular Volume (MCV): 70 fL-

Mean Corpuscular Hemoglobin (MCH): 20 pg

What is the most likely diagnosis?

A) Iron deficiency anemia
B) Vitamin B12 deficiency anemia
C) Chronic kidney disease
D) Thalassemia
E) Anemia Of Chronic Disease

- **Question 2**

A patient's liver function test (LFT) shows:-

- Alanine Transaminase (ALT): 200 IU/L

- **Aspartate Transaminase (AST): 150 IU/L**
- **Bilirubin: 2 mg/dL**

What is the most likely diagnosis?

A) Hepatitis
B) Cirrhosis
C) Cholestasis
D) Pancreatitis
E) Gallstones

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Skill Lab Assessment

- **Question 3**

A patient's electrolyte panel shows:-

Sodium: 120 mEq/L

- Potassium: 6.5 mEq/L

- **Chloride: 90 mEq/L**

What is the most likely diagnosis?

A) Hyponatremia
B) Hyperkalemia
C) Metabolic acidosis
D) Adrenal insufficiency
E) Respiratory Alkalosis

- **Question 4**

A patient's renal function test shows:-

Serum Creatinine: 2.5 mg/dL

Blood Urea Nitrogen (BUN): 40 mg/dL

eGFR: 30 mL/min/1.73m²

- What is the most likely diagnosis?

- A) Acute kidney injury (AKI)
- B) Chronic kidney disease (CKD)
- C) End-stage renal disease (ESRD)
- D) Nephrotic syndrome
- E) Nephritic Syndrome

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Skill Lab Assessment

- **Question 5**

A patient's lipid profile shows:-

Total Cholesterol: 250 mg/dL-

LDL Cholesterol: 180 mg/dL

HDL Cholesterol: 30 mg/dL

Triglycerides: 200 mg/dL

What is the most likely diagnosis?

A) Hypertriglyceridemia
B) Hypercholesterolemia
C) Mixed dyslipidemia
D) Low HDL cholesterol
E) Low LDL Cholesterol

- **Question 6**

A patient has high serum urea and normal creatinine. The likely cause is:

A. Acute kidney injury
B. Chronic kidney disease
C. Pre-renal azotemia
D. Post-renal obstruction
E. Rhabdomyolysis

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Skill Lab Assessment

- **Question 7**

Elevated serum alkaline phosphatase (ALP) with normal GGT suggests:

A. Biliary obstruction
B. Bone disease
C. Alcoholic liver disease
D. Viral hepatitis
E. Hemochromatosis

- **Question 8**

An HbA1c level of 8.2% reflects:

A. Normal glucose control
B. Hypoglycemia
C. Pre-Diabetes
D. Diabetes with poor control
E. Recent fasting state

- **Question 9**

A very low HDL level in a lipid profile increases risk of:

A. Renal failure
B. Pancreatitis
C. Cardiovascular disease
D. Hyperthyroidism
E. Stroke due to embolism

- **Question 10**

A low serum albumin with normal total protein suggests:

A. Malabsorption
B. Selective Albumin loss
C. Acute hepatitis
D. Multiple myeloma
E. Hypothyroidism

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Key

1. A
2. A
3. A
4. B
5. C
6. C
7. B
8. D
9. C
10. B

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Learning Objectives

At the end of the Skill Lab, students will be able to understand:

1. Lab tests reliability (Accuracy vs Precision)
2. Reporting and interpretation of lab results
   -True vs false positive and negative lab results
   - Why do values of reference ranges vary from lab to lab?
   -Things that can alter lab test results in individuals
3. Reference range
4. Common Biochemical Lab Tests
5. Interpretation of a disease through lab tests.

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Interactive Session

- A 65-year-old male patient, Mr. XYZ presents to the emergency department with:- Fatigue- Swelling in legs and feet- Shortness of breath- Confusion
- Medical History:- Hypertension- Diabetes mellitus- Coronary artery disease
- **Lab Reports:-**

Serum creatinine: 3.5 mg/dL (elevated)-

Blood urea nitrogen (BUN): 60 mg/dL (elevated)-

Potassium: 6.2 mEq/L (elevated)-

Sodium: 130 mEq/L (low)-

Hemoglobin: 10 g/dL (low)-

Urinalysis: - Proteinuria (3+) Hematuria (2+)

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Core Concept

Principle

- Clinical laboratory test results are a very important parameter in **diagnosis**, **monitoring** and **screening.**
- The laboratory result must be interpreted on the background of a **reference interval** that is used to distinguish between "health" and "disease".
- Influence of **random errors** and **systematic errors** on the result Is important for diagnostic specificity and sensitivity.

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Core Concept

Precision and Accuracy of a Lab Test

• **PRECISION:**

A test is precise when **repeated** determinations (**analyses**) on the **same sample give similar results**. The possibility of random errors is small in a precise lab test.

• **ACCURACY:**

A test is said to be **accurate** when it **measures what it is supposed to measure**. **OR**

A test that can measure the **true amount** or concentration of a substance in a sample

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Core Concept

Reliability of a Lab Test

- Statistical measurements of **accuracy** and **precision** reveal a test's basic reliability.
- A test method can be precise (reliably reproducible in what it measures) without being accurate (actually measuring what it is supposed to measure), or vice versa.
- Tests, instruments, and laboratory personnel each introduce a small amount of variability (errors). So, for a test to be 100% Accurate and Precise at the same time is not possible.

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Core Concept

Positive and Negative Test Result

• **A positive test:** the substance or condition tested for, was found. **OR**

The amount of substance being tested for is higher or lower than normal.

• **A negative test:** The substance or condition tested for, was not found. **OR**

The substance that was tested for was of normal amount.

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Core Concept

False Positive and False Negative Result

- **False positive test result**:

shows a disease or condition is present **when it is not present.**

- **False negative test result**:

does not detect what is being tested for **even though it is present.**

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Core Concept

An Inconclusive Result

That are neither clearly positive nor negative.

Either the test needs to be done again or a different kind of test needs to be suggested.

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Core Concept

Reference Range

- A **set of values** that includes **upper and lower limits** of a lab test based on a group of otherwise healthy people.
- Determined by testing large groups of healthy people to find what is normal for that group

Why do values of reference ranges vary?

1. Gender
2. Age
3. Geographical locations
4. Physiological changes e.g Pregnancy
5. Equipment and lab testing methods for analysis.

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Core Concept

Reference Range

Age	Hemoglobin Lower limit (g/dL)	MCV Lower limit (fL)	MCV Upper Limit (fL)
1 year	11	71	89
2 to 3 years	11	74	89
4 to 6 years	11.7	77	91
7 to 10 years	12	78	91
11 to 14 years			
female	12,3	80	94
male	12,6	80	94
15 to 18 years			
female	11.5	81	96
male	13.7	81	96

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Core Concept

Reference Range Variation amongst Labs

Each laboratory must determine its own reference ranges whether by;

1. Testing a pool of perceived normal and healthy individuals
2. Citing reference ranges from test manufacturers or other laboratories.

Physicians should not compare results from different labs.

- Only a handful of tests, such as blood sugar (eg; FBG level of >7.0 mmol/L - DM), have standardized reference ranges that all labs use, regardless where the test is done.

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Core Concept

Method Of Interpretation

1. **Patient Information**: Verify the patient's details, such as name, age, and gender.
2. **Test Name and Type**: Identify the biochemistry test performed (e.g., blood, urine, or cerebrospinal fluid analysis).
3. **Reference Range**: Note the normal reference range for each parameter. This range varies depending on age, gender, and laboratory methods.
4. **Results**: Compare the patient's results to the reference range. Values outside this range may indicate abnormalities.
5. **Units**: Be aware of the units used (e.g., mg/dL, mmol/L, or IU/L).
6. **Flagging**: Look for flags or indicators (e.g., "H" for high or "L" for low) that highlight abnormal results
7. **Interpretation**: Consider the patient's medical history, symptoms, and other diagnostic results when interpreting the lab report.

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Core Concept

Common Biochemical Lab Tests

Some common biochemistry tests include:-

1. **Haematology Panel:** Complete Blood count and Culture
2. **Renal Panel**: Urea, Creatinine, Urinalysis and Culture
3. **Liver Panel**: Liver Function Tests (LFTs): Alanine transaminase (ALT), Aspartate transaminase (AST), Alkaline phosphatase (ALP), Bilirubin, and Albumin.-

Chemistry Panel:

1. **Electrolyte**: Na+, K+, Cl-, HCO_3^-, H+
2. **Lipid Profile**: Cholesterol, Triglycerides, High-density lipoprotein (HDL), and Low-density lipoprotein (LDL).-
3. **Glucose Tests**: Fasting Blood Sugar (FBS), Postprandial Blood Sugar (PPBS), and Glycated Hemoglobin (HbA1c).
4. **Cerebrospinal fluid analysis**

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Core Concept

Circumstances Altering the Lab Test Results

On part of the Patient
Non-Compliance to protocols,

1. Intense physical activity (BUN, creatinine, uric acid, ALT, AST and direct bilirubin, PSA remain elevated **24 hours** after a strenuous activity.
2. Improper Sample Collection : e.g Urine R/E
3. Use of Medicines: e.g Hypoglycemics and Steroids
4. Stress can alter lipid profiles.
5. Food : Fasting state and Fed state have different results for Blood lipid and Blood glucose levels.

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Core Concept

Circumstances Altering the Lab Test Results

• **On part of the Laboratory Staff:**

1. Mishandling
2. Wrong labels
3. Improper Amount Collection
4. Equipment malfunction

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Horizontal Integration

Anatomy of The Human Body

There are 11 organ systems in the human body:

1. **The Skeletal System**
2. **The Muscular System**
3. **The Lymphatic System**
4. **The Respiratory System**
5. **The Digestive System**
6. **The Nervous System**, including the central and autonomic systems
7. **The Endocrine System**, which regulates hormone production
8. **The Cardiovascular System**, including the heart
9. **The Urinary System**
10. **The Reproductive System**
11. **The Integumentary System**, which includes the skin, hair, and nails, among other areas

These systems all work together and depend on each other to function.

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Horizontal Integration

Physiology of The Human Body

The Systems Covered in Physiology are as follows:

- **Circulatory system** – properties of the blood, and how circulation works.
- **Digestive/excretory system** – the conversion of food into fuel and its final exit from the body.
- **Endocrine system** – the study of endocrine hormones that carry signals throughout the organism, helping it to respond.
- **Immune system** – A complex array of receptors and molecules combine to protect the host from attacks by pathogens.
- **Integumentary system** – the skin, hair, nails, sweat glands, and sebaceous glands.
- **Musculoskeletal system** – Bone marrow – where red blood cells are made – and how bones store calcium and phosphate.
- **Nervous system** – includes research into the senses, memory, emotion, movement, and thought.
- **Renal/urinary system** – removes water from the blood, produces urine, and carries away waste.
- **Reproductive system** – gonads and the sex organs. Also includes investigating the way a fetus is created and nurtured for 9 months.
- **Respiratory system** – brings in oxygen and expels carbon dioxide and water.

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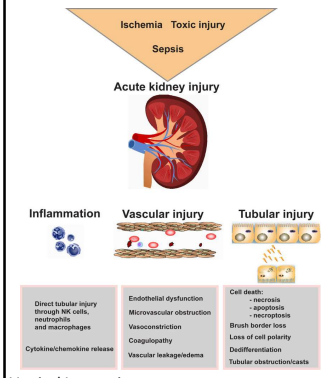
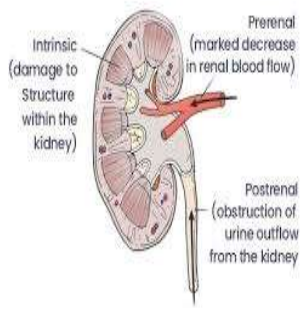
Acute on Chronic Renal failure (ACRF)





Vertical Integration

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Vertical Integration

Acute on Chronic Renal failure (ACRF)

Treatment and Management:

1. Fluid management:- Restrict fluids to 1 L/day - Monitor fluid balance
2. Electrolyte management: - Potassium-binding resins (Kayexalate) - Sodium bicarbonate supplements
3. Renal replacement therapy: - Hemodialysis (HD) or continuous renal replacement therapy (CRRT)
4. Medications: - ACE inhibitors or ARBs (if not contraindicated) - Beta-blockers - Erythropoietin (for anemia)
5. Dietary modifications: - Low-protein diet - Low-sodium diet - Low-potassium diet
6. Monitoring: - Regular lab tests (creatinine, BUN, electrolytes) - Fluid balance and weight monitoring

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Spiral Integration | Family Medicine

Management of ACRF

Family Medicine plays important role in following manner:

- Diagnosis
- Education
- Dietary Guidance
- Monitoring
- Refer to Specialists

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Spiral Integration | Artificial Intelligence

Role of AI in Management

Artificial Intelligence plays role in following aspects:

- Personalized Nutrition
- Diagnostic Tools
- Food Recommendations
- Drug Development

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Spiral Integration | Research Article

Risk Factors For Rapid Kidney Function Decline In Diabetes Patients

Jixin Xing,Linxi Huang,Weifu Ren &Xiaobin Mei

Renal Failure Volume 46, 2024 - Issue 2

Link:

https://www.tandfonline.com/doi/full/10.1080/0886022X.2024.2398188

Abstract:

Diabetic nephropathy, as a severe microvascular complication of diabetes, manifests in four clinical types: classic, albuminuria regression, a rapid decline in kidney function (RDKF), and non-proteinuric or non-albuminuric DKD. Rapidly progressive diabetic nephropathy advances to end-stage renal disease more swiftly than the typical form, posing significant risks. However, a comprehensive understanding of rapidly progressive diabetic nephropathy is currently lacking. This article reviewed latest developments in genetic and clinical risk factors associated with rapidly progressive diabetic nephropathy, aiming to broad perspectives concerning the diagnosis and interventions of this condition.

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Spiral Integration | Bioethics

Ethical Consideration

- Informed Consent
- Health care must allocate sources fairly, transparently and equitably
- Maintaining patient's confidentiality
- Research ethics

Spiral Integration 32

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How to use HEC Digital Library

Steps to Access HEC Digital Library

1. Go to the website of HEC National Digital Library
   http://www.digitallibrary.edu.pk
2. On Home Page, click on the INSTITUTES.
3. A page will appear showing the universities from Public and Private Sector and other Institutes which have access to HEC National Digital Library (HNDL).
4. Select your desired Institute.
5. A page will appear showing the resources of the institution
6. Journals and Researches will appear
7. You can find a Journal by clicking on JOURNALS AND DATABASE and enter a keyword to search for your desired journal.

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Learning Resources

- Google scholar
- Google images

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