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Physiotherapy in General Medical and Surgical Conditions

Megha Sandeep Sheth
Priya Singh Rangey
Neeta Jayprakash Vyas
Srishti Sanat Sharma

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2 Biochemical Investigations in Medical and Surgical Conditions

Ajay Junnarkar, Sandeep Sheth

LEARNING OBJECTIVES

At the end of the chapter, the reader will be able to:

- Know some common tests undertaken in medical conditions.
- Know about the role of acute phase reactants in medical conditions.
- Learn the important investigations for surgical conditions.
- Know some of the investigations done in skin diseases.
- Understand the biochemical investigations in diabetes.
- Understand the biochemical investigations in obstetric conditions and its interpretation.
- Know some of the investigations done in lifestyle diseases.

CHAPTER OUTLINE

- Introduction
- Some Common Tests
  - Complete Blood Count
  - Renal Function Tests
  - Liver Function Tests
- Acute Phase Reactants
  - C-reactive Protein
  - Fibrinogen
  - Transferrin and Ferritin
- Surgical Conditions
- Skin Diseases
- Diabetes
  - Diabetes Diagnosis Criteria
  - HbA1c
- Obstetric Conditions: Pregnancy
  - hCG
  - Progesterone
  - Maternal Prenatal Screening
- Lifestyle Diseases
  - Vitamin B_{12}
  - Vitamin D
  - Dyslipidemia
- Investigations in COVID

INTRODUCTION

Laboratory tests play a vital role in healthcare. The usual purpose of performing tests is to aid in the clinical diagnosis. With advances in techniques and technology the laboratory's role has expanded in the field of medicine—it now provides useful information in prognostication, detects specific diseases, helps in determining predisposition to certain conditions, and monitors therapy. With the advent of genetic and molecular testing the laboratory has become indispensable in diagnosing, prognosticating, and monitoring cancer and its progression.

The selection of appropriate laboratory tests is driven by the presenting clinical signs and symptoms. Inflammation is frequently the body's first response to tissue injury—microbial, chemical, traumatic, autoimmune, neoplastic, etc. The immediate immune response is both cellular and biochemical. The biochemical response manifests by alteration of specific proteins, known as acute phase reactants, in the blood. These are primarily synthesized in the liver and serve as potential biomarkers of inflammation.

SOME COMMON TESTS

Health checkups include the following investigations to diagnose presence of diseases **(Box 2.1)**.

Some of these are described later in the chapter.

Complete Blood Count

It is the most basic but one of the most vital blood investigations which can provide a lot of information. Complete blood

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Box 2.1: List of laboratory investigations for health checkups.

- CBC, ESR
- PT, APTT
- Blood sugar (FBS, RBS)
- Renal functions (urea, creatinine, electrolytes)
- Liver function (bilirubin, SGPT, serum proteins)
- Tests for hepatitis B, HCV, HIV
- Urine routine and micro
- Thyroid functions (T_3, T_4, TSH)
- Lipid profile
- Uric acid, calcium, phosphorous
- Vitamin B_{12}, vitamin D, ferritin
- Tumor markers such as serum PSA in men, Ca 125 in women

(APTT: activated partial thromboplastin time; CBC: complete blood count; ESR: erythrocyte sedimentation rate; PSA: prostate-specific antigen; SGPT: serum glutamate pyruvic transaminase; HIV: human immunodeficiency virus; HCV: hepatitis C virus; FBS: fasting blood sugar; RBS: random blood sugar; TSH: thyroid stimulating hormone)

count (CBC) includes hemoglobin with derived parameters, white blood counts, and platelets.

- Hemoglobin: Indicator of anemia and types
- WBC count: Indicator of infection (bacterial, viral)
- Platelets along with PT, APTT: Indicator of bleeding disorder
- Erythrocyte sedimentation rate (ESR): Raised ESR is a good indicator of chronic infection, inflammatory conditions such as rheumatoid arthritis, autoimmune disorders, and neoplasms (multiple myeloma).

Renal Function Tests

They are performed in prerenal conditions, renal conditions and postrenal conditions for the following reasons:

- To assess functional capacity of kidneys
- To diagnose renal impairments
- To assess severity and progression of renal impairment
- To assess effectiveness of treatment

Table 2.1 gives the normal values of some parameters of renal function.

Table 2.1: Normal values of parameters of renal function.

Parameters of renal function	*Normal values/Reference range*
Serum urea	15–45 mg/dL
Creatinine	0.6–1.2 mg/dL
Uric acid	Males 3.5–7.2 mg/dL Females 2.6–6.0 mg/dL
Electrolytes Na K Cl Ca Phosphate	 136–146 mEq/L 3.5–5.1 mEq/L 101–109 mEq/L 8.8–10.2 mg/dL 2.8–4.0 mg/dL
Total protein	6.4–8.1 g/dL
Serum albumin	3.2–4.6 g/dL

Table 2.2: Normal values of parameters of liver function.

Parameters of liver function	*Normal values/Reference range*
Serum ALT/SGPT	7–55 U/L
Serum AST/SGOT	8–48 U/L
Alkaline phosphatase (ALP)	40–129 U/L
Bilirubin	0.1–1.2 mg/dL

Liver Function Tests

Liver function tests are used to monitor liver disease or damage. They can be used to

- Screen for liver infections such as hepatitis
- Measure severity of disease particularly scarring (cirrhosis)
- Monitor progression of disease such as viral or alcoholic hepatitis
- Monitor possible side effects of medications

Table 2.2 gives normal values of parameters of liver function.

ACUTE PHASE REACTANTS

C-reactive protein (CRP), fibrinogen, transferrin, ferritin, alpha-1 antitrypsin, lactoferrin, Albumins are some of the biochemical markers used to monitor inflammation.

C-reactive Protein

- C-reactive protein (CRP) is a valuable marker and highly sensitive in acute inflammation (especially bacterial infections) and tissue necrosis.
- It has a half-life of about 19 hours and blood levels are typically elevated 4–8 hours after tissue injury. Blood levels return to normal 48–72 hours after cessation of inflammation.
- Persistent elevation usually indicates ongoing inflammation or chronic infection.
- Of late, it has been used to predict risk of cardiovascular disease, given the role of proinflammatory factors in atherogenesis and vascular endothelial damage.
- **Normal reference range <6 mg/L**.

Fibrinogen

- **Normal plasma levels are 150–400 mg/dL**. These may be elevated 10–15 fold during infection. The ESR also increases as a result.
- Low fibrinogen levels can result from activation of the coagulation pathway, due to consumption at the site of injury.

Transferrin and Ferritin

- **Normal range for Transferrin is 200–400 mg/dL**. It is a measure of the total iron binding capacity (TIBC) in the serum.
- Low transferrin levels are seen in infection, liver and kidney damage and malignancies.
- It is usually assayed with serum ferritin which rises in infective and inflammatory conditions.

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SURGICAL CONDITIONS

Surgery is an integral part of modern medicine. Conditions requiring either planned or emergency surgeries can affect almost any part of the human anatomy. A thorough presurgical work-up as well as postsurgical monitoring are essential for optimal outcomes. An assessment of the "performance status" through laboratory tests plays a central role before all surgical procedures. The purpose is to assess the capability to withstand the stress of anesthesia and surgery and it therefore involves performing blood tests relevant to the major organ systems of the body. A thorough and relevant history and examination are, of course, absolutely necessary before requisitioning laboratory testing. It must be realized that the following list, which is given in **Table 2.3**, is not exhaustive and may be modified according to the patient's clinical condition.

Most of these investigations provide a baseline against which a patient's progress may be monitored in the postsurgical period. Specific assays like tumor markers (e.g., CEA, AFP, CA 19-9) in malignancies or cytokine levels in organ transplant patients will help in monitoring progress of the relevant conditions.

Burn wounds often require emergency care and hospitalization, especially those with fire/flame burns and electrical injuries. Skin is the largest organ of the body. Severity of burn injury depends on several factors such as type of heating agent, temperature, contact duration, rate of heat transfer and tissue conductivity. Besides local damage at point of contact, systemic inflammatory responses also occur due to release of cytokines and other mediators into the circulation. Though hypovolemic shock due to fluid loss accompanied by electrolyte imbalance needs immediate management, the ensuing hypermetabolic state causes much of the morbidity and mortality in burn wounds. Laboratory tests are an essential component in the evaluation of the degree of thermal injury. CBC, electrolytes, renal function tests, liver function (especially protein and albumin) are part of the work-up in burns patients.

Table 2.3: Some investigations according to the system being investigated.

System	*Some investigations*
Hematology and coagulation	CBC, prothrombin time, APTT
Renal function	Urea, creatinine, uric acid
Liver function	Bilirubin, SGPT, SGOT, alkaline phosphatase, GGT, protein and albumin
Immunological	HbsAg, HIV, HCV
Metabolic	FBS/PPBS/RBS, electrolytes
Thyroid function	TSH
For blood transfusion	Blood group
Urinary tract	Urine routine/micro

(CBC: complete blood count; APTT: activated partial thromboplastin time; SGPT: serum glutamate pyruvic transaminase; SGOT: serum glutamate oxaloacetic transaminase; GGT: gamma-glutamyl transpeptidase; HbsAg: hepatitis B surface antigen; HIV: human immunodeficiency virus; HCV: hepatitis C virus; FBS: fasting blood sugar; PPBS: postprandial blood sugar; RBS: random blood sugar; TSH: thyroid stimulating hormone)

SKIN DISEASES

Skin disorders are generally diagnosed by looking at the skin. Biopsies, scrapings (for fungus, viruses), patch test and diascopy are quite useful. Serological investigations are used in autoimmune disorders involving the skin primarily (pemphigus, pemphigoid, dermatitis herpetiformis, vasculitis) or as part of a systemic disease (SLE, rheumatoid arthritis). Detection of autoantibodies is highly useful in the work-up of cutaneous bullous disease.

Allergic disorders are a major public health concern. Laboratory tests are useful in the evaluation of patients with allergic diseases. Immunoglobulin E (IgE) is the most important trigger molecule for allergic inflammation. Serum assays of total IgE and allergen specific IgE are useful in identifying individuals with an atopic/allergic state and in making an initial diagnosis. Utility of these tests to monitor treatment is limited. Elevated levels can also be found in primary immunodeficiencies, infections (especially parasitic), inflammations, and malignancies. **The normal levels in adults are usually < 214 kU/L (Table 2.4)**.

Clinical Pointer

Measurement of IgE antibodies is useful and can be recommended in the following clinical situations:

- To evaluate children with early clinical signs of allergic disease, including children with eczema, gastrointestinal symptoms, wheezing, and rhinitis
- To evaluate children and adults suspected of having allergic respiratory disease to establish the diagnosis and to define the specificity of allergen sensitization to pollens, dust mites, mold allergens, and foods
- To confirm sensitization to food allergens in patients with signs of clinical food allergy
- To identify allergens for use in immunotherapy regimens in patients with severe allergic rhinitis
- To evaluate the specificity of sensitization to insect venom allergens
- To confirm the diagnosis of penicillin hypersensitivity in patients with recent clinical reactions
- To confirm the presence of sensitization and possible allergy to occupational allergens

DIABETES

Diabetes mellitus is a syndrome with disordered metabolism and inappropriate hyperglycemia caused by either deficient insulin secretion or insulin resistance or a combination of both. In India, diabetes is considered to be a potentially explosive public health situation with rising prevalence rates since the last three decades.

The laboratory plays a major role in the diagnosis and monitoring of diabetes. Home-monitoring is also recommended, especially for type I diabetes. Since dyslipidemia is also a feature of diabetes, serum lipid monitoring is an essential part of controlling this disorder.

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Table 2.4: Reference values for immunoglobulin E (IgE).

Results reported in kU/L	
Age	***Reference interval***
0–5 months	≤13
6–11 months	≤34
1 and 2 years	≤97
3 years	≤199
4–6 years	≤307
7 and 8 years	≤403
9–12 years	≤696
13–15 years	≤629
16 and 17 years	≤537
18 years and older	≤214

Diabetes Diagnosis Criteria

Box 2.2 shows the diagnostic criteria by the American Diabetes Association (ADA).

Self-monitoring of blood glucose (SMBG) with the help of glucometers is useful in monitoring type I diabetes and type II diabetes patients on insulin therapy. A longitudinal profile of blood glucose will aid in making day-to-day decisions, especially in patients with wide fluctuations in their sugar levels. **For optimal control ADA recommends a preprandial blood glucose range of 70–130 mg/dL and a peak post-prandial target of < 180 mg/dL**.

HbA1c

Glycated hemoglobin (HbA1c) refers to a specific fraction of adult hemoglobin (HbA), which is present in normal as well as diabetic populations. It is formed when the N-terminal valine of the beta chain of hemoglobin A is modified by the addition of a sugar moiety by a non-enzymatic process. Since it is stable it reflects the degree of glycation over a period spanning the RBCs life-span, roughly 120 days. **Box 2.3** shows the reference ranges for HbA1c levels.

The recommended frequency of monitoring is twice a year in patients who meet their glycemic goals and four times a year in those who do not. The blood sample for this test can be drawn anytime of the day (does not require fasting) and needs no special handling. As of January, 2010, the ADA began promoting the use of HbA1c as the preferred diagnostic test for diabetes mellitus.

Box 2.2: Diagnostic criteria by the American Diabetes Association (ADA).

- A fasting plasma glucose (FPG) level of 126 mg/dL (7.0 mmol/L) or higher, *or*
- A 2-hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher during a 75-g oral glucose tolerance test (OGTT), *or*
- A random plasma glucose of 200 mg/dL (11.1 mmol/L) or higher in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, *or*
- A hemoglobin A1c (HbA1c) level of 6.5% (48 mmol/mol) or higher

Box 2.3: The reference ranges for glycated hemoglobin (HbA1c) levels.

- Adult or child, without diabetes: 4–5.9%
- Good diabetic control: < 7%
- Fair diabetic control: 8–9%
- Poor diabetic control: >9%

OBSTETRIC CONDITIONS: PREGNANCY

The diagnosis of pregnancy is a multipronged approach, using history and physical examination, laboratory tests and ultrasonography. All these three modalities may be required to diagnose early pregnancy. Presence of human chorionic gonadotropin (hCG) in urine or serum provides one of the means of detecting and monitoring pregnancy.

hCG

- hCG is a glycoprotein similar in structure to follicle-stimulating hormone (FSH), luteinizing hormone (LH), and thyroid stimulating hormone (TSH).
- hCG is composed of alpha and beta subunits. The alpha subunit of hCG is similar to the alpha subunit of FSH, LH, and TSH. The free beta subunit of hCG is the portion that differs from the others and, along with the intact hormone, is the target of most sensitive assays.
- hCG is detectable in more than 98% of pregnant patients about 11–12 days after conception.
- **For males and nonpregnant females, the normal level for hCG is < 2 IU/L.** With regard to the detection of pregnancy in females, hCG values are shown in **Box 2.4**.

Progesterone

- Progesterone is produced in the luteal phase of the menstrual cycle.
- Progesterone decreases endometrial proliferation and develops secretory endometrium. The sudden drop in progesterone toward the end of the cycle induces endometrial lysis and the onset of menstruation.
- It helps to maintain pregnancy by suppressing menstruation and uterine contractility.
- Progesterone serum levels increase from approximately 2,500 ng/dL during the midluteal phase to 15,000 ng/dL at the end of pregnancy. Reference ranges for progesterone are shown in **Box 2.5**.

Box 2.4: Interpretation of hCG.

- Negative: < 5 IU/L
- Indeterminate: 5–25 IU/L
- Positive: >25 IU/L

Note: Serum total hCG concentration peaks at about 93,000 mIU/mL (range 27,300–233,000 mIU/mL) at 8–11 weeks of gestation.

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Box 2.5: Reference ranges for progesterone.

- 9 years: <20 ng/dL
- 10–15 years: <20 ng/dL
- Adult male: 10–50 ng/dL
- Adult female:
  - Follicular phase: <50 ng/dL
  - Luteal: 300–2,500 ng/dL
  - Postmenopausal: <40 ng/dL
- Pregnancy:
  - First trimester: 725–4,400 ng/dL
  - Second trimester: 1,950–8,250 ng/dL
  - Third trimester: 6,500–22,900 ng/dL

Maternal Prenatal Screening

Second-trimester screening of a pregnant woman's serum for markers of such congenital abnormalities as fetal trisomy 21 (Down syndrome) and neural tube defects has become an important part of antenatal care. The protocol most commonly used is the triple marker screen, which measures:

- Serum levels of alpha-fetoprotein (MSAFP)
- Unconjugated estriol (uE3)
- Beta-human chorionic gonadotropin (beta-hCG)

The results of these tests are used to derive a value known as a ***multiple of the median*** (MoM). An algorithm that combines maternal age with MoMs can be used to calculate the risk for such chromosomal disorders as trisomy 21 and 18.

- AFP alone-corrected for weight, race, insulin-dependent diabetes, and multiple pregnancy - can be used to predict the risk of fetal neural tube defect.
- Triple marker screening identifies about 60–75% of trisomic pregnancies and more than 90% of neural tube defects in the population screened.
- A "quadruple test" screen is also used in the second trimester, combining inhibin assay with the triple marker test. The quadruple test is usually performed at 15–18 weeks of gestation but can be done as late as 22 weeks.

Early assessment for trisomy 21 can also be done between 9 and 12 weeks by measuring maternal serum pregnancy associated plasma protein (PAPP-A) and serum beta-hCG.

- PAPP-A is a complex, high molecular weight glycoprotein with levels that are lower in pregnancies affected with fetal trisomy 21. As a marker, PAPP-A decreases with increasing gestational age between 9 and 13 weeks. Low PAPP-A in the first trimester has been associated with fetal loss, abruption, preeclampsia, and fetal growth restriction.
- In contrast, beta-hCG levels on average will double in pregnancies at risk for trisomy 21.

Table 2.5 shows the patterns of triple screen test results and their interpretations.

Table 2.5: Patterns of triple screen test results and their interpretations.

Condition	*MSAFP level*	*uE3 level*	*hCG level*
NTD	Increased	Normal	Normal
Trisomy 21	Low	Low	Increased
Trisomy 18	Low	Low	Low
Molar pregnancy	Low	Low	Very high
Multiple gestation	Increased	Normal	Increased
Fetal death (stillbirth)	Increased	Low	Low

(hCG: human chorionic gonadotropin; MSAFP: maternal serum alpha fetoprotein; NTD: neural tube defects; uE3: unconjugated estriol)

LIFESTYLE DISEASES

Lifestyle diseases are ailments that are primarily based on the day to day habits of people. Habits that detract people from activity and push them toward a sedentary routine can cause a number of health issues that can lead to chronic noncommunicable diseases that can have near life-threatening consequences. Diet, exercise and adoption of healthy habits help not only in preventing diseases but also in managing conditions such as obesity, hypertension, hyperlipidemia and diabetes.

Good dietary habits are essential to maintain health, development, and longevity. The intake of macro- and micronutrients according to recommended allowances provide optimum nutrition and the prevention of deficiency symptoms or diseases. Of all the micronutrients, twenty three vitamins and trace elements are collectively termed essential micronutrients. They are needed in small amounts for metabolism of proteins, carbohydrates, and fats, and for the body's structure (e.g., vitamin K in bone matrix).

Measurement of vitamin and trace element levels is sometimes helpful in nutritional assessment.

Vitamin B_{12}

- Vitamin B_{12}, or cobalamin, is crucial for DNA synthesis in cells, particularly those with rapid turnover, such as hematopoietic cells, which are vital to the optimal function of the immune system.
- Demands for vitamin B_{12} increase during times of physical stress.
- Exogenous sources of B_{12} are meat and dairy products, which provide the B_{12} that we absorb on a daily basis in the presence of an acidic stomach and intrinsic factor.
- Vitamin B_{12} deficiency **(Box 2.6)** is one of the major causes of macrocytic anemia but may also be present in normocytic patients. A deficiency of vitamin B_{12} promotes neurologic deficits, such as bilateral paresthesias of the lower extremities, loss of vibratory sensation, and disequilibrium-neurologic deficits that significantly affect quality of life, making this nutritional deficit worthy of recognition and treatment.

Vitamin D

Vitamin D (cholecalciferol) plays an essential role as a hormone in the control of calcium and phosphorus

Box 2.6: Normal values for vitamin B_{12}.

Serum vitamin B_{12} levels have a wide range of normal, reference range is **200–800 pg/mL**.

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metabolism. UV light exposure of the skin converts naturally occurring 7-dehydrocholesterol to cholecalciferol or Vitamin D_3. Diet-derived cholecalciferol from animal sources is called ergocalciferol or Vitamin D_2. Both vitamin D_3 and vitamin D_2, require two hydroxylations to convert to its active form—1,25 dihydroxycholecalciferol. Most of the laboratory instruments assay 25-hydoxy vitamin D as it is more stable in serum and has a longer half-life.

- Vitamin D deficiency and insufficiency have been defined as a 25-hydroxyvitamin D <20 ng/mL and 21–29 ng/mL, respectively.
- For every 100 IU of vitamin D ingested, the blood level of 25-hydroxyvitamin D status increases by 1 ng/mL.
- It is estimated that children need at least 400–1,000 IU of vitamin D a day while teenagers and adults need at least 2,000 IU of vitamin D a day to satisfy their body's vitamin D requirement.

Dyslipidemia

Dyslipidemia refers to an abnormality within the lipid profile, encompassing a variety of disorders relating to:

- Elevations in total cholesterol, LDL, or triglycerides (TG), or
- Conversely, lower levels of HDL

The dyslipidemia may present as a single disorder affecting only one lipoprotein parameter, or may represent a combination of lipoprotein abnormalities, such as elevated TG and low HDL.

In the clinical setting,

- A primary dyslipidemia typically refers to a genetic defect in the lipid metabolism as a cause of the problem. For example, familial hypercholesterolemia is a cause of primary dyslipidemia.
- A secondary dyslipidemia may be attributed to another cause. For example, environmental factors (such as a diet rich in saturated fat or a sedentary lifestyle), diseases (such as diabetes, hypothyroidism, obstructive liver disease), and medications (such as thiazide diuretics, progestins, or anabolic steroids) may result in a secondary dyslipidemia, which could be potentially resolved by correcting the underlying condition.
- The association between cholesterol and cardiovascular disease is well-established. Assessment and treatment of dyslipidemia is an important component of treatment of cardiovascular disease.

National guidelines recently published in Canada and the United States address risk stratification and intervention based on individual lipid profiles and risk factors **(Tables 2.6 and 2.7)**.

INVESTIGATIONS IN COVID

Reverse Transcription Polymerase Chain Reaction (RT-PCR) test is done for diagnosis of COVID by oral and nasal swab. It is a molecular test done in National Accreditation Board for Testing and Calibration Laboratories (NABL) and Indian

Table 2.6: Lipid profiles.

LDL cholesterol	
<100	Optimal
100–129	Near optimal/above optimal
130–159	Borderline high
160–189	High
≥190	Very high
Total cholesterol	
<200	Desirable
200–239	Borderline high
≥240	High
HDL cholesterol	
<40	Low
≥60	High

(HDL: high-density lipoprotein; LDL: low-density lipoprotein)

Table 2.7: Interpretation of lipid values.

Serum lipoproteins	*Fasting values (mg/dL)*	*Interpretation*
Total cholesterol	<200	Desirable
	200–239	Borderline high
	≥240	High
LDL cholesterol	<100	Optimal
	100–129	Near optimal
	130–159	Borderline high
	160–189	High
	≥190	Very high
HDL cholesterol	<40	Low
	≥60	High
	<150	Desirable
Triglycerides	150–199	Borderline high
	200–499	High
	≥500	Very high

(NCEP ATP III: National Cholesterol Education Program-Adult Treatment Panel III)

Table 2.8: Investigations in coronavirus disease (COVID).

System	*Some investigations*	*Interpretation*
Hematological	CBC, Hb, total leukocytes, differential leukocytes–ratio of neutrophils and lymphocytes	
Blood coagulation parameters	D-Dimer PT APTT	Increased levels of D-Dimer indicate thrombosis
Biochemical investigations	Renal function: Creatinine Liver function: Total bilirubin, SGPT, LDH	
Serological tests	Serum CRP Ferritin	
Immunological	IL-6	Increased levels indicate cytokine storm

(APTT: activated partial thromboplastin time; CBC: complete blood count; CRP: C-reactive protein; LDH: lactate dehydrogenase; SGPT: serum glutamic pyruvic transaminase)

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Council of Medical Research (ICMR) approved molecular laboratory equipped with specialized instruments.

Once the test is positive the following tests **(Table 2.8)** are done as baseline investigations. They are subsequently repeated based on patient symptoms and clinical picture.

Clinical Pointer

One should not be treating as per laboratory parameters, but laboratory reports should always be clinically correlated. Medical management should always be left to the treating physician.

Summary

Biochemical investigations play a vital role in the diagnostic and prognostic evaluation of any subject. Various biochemical investigations are performed for medical and surgical purposes. Normal values of each investigation may vary depending on the gender and age of the individual. It is believed that diagnosis in medicine is an art and not science. But biochemical investigations play a crucial role in this art process. Around 80% cases can be diagnosed based on clinical information alone. But for the rest of them, biochemical investigations and radiological investigations are required. They are even required to know whether the diagnosis formulated is correct or not, whether the management is effective or not. Due to these reasons, having knowledge of biochemical investigations is imperative for the practicing physiotherapist as well.

REVIEW QUESTIONS

1. Describe some of the investigations in medical conditions.
2. Describe the interpretation of investigations in diabetes.
3. Which are the biochemical investigations in obstetric conditions?
4. Which are the investigations done for diagnosis and management of lifestyle diseases?

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Physiotherapy in General Medical and Surgical Conditions

The goal of the authors when writing this book was to provide a textbook and a reference book for students, clinicians and academicians. It contains important and common medical and surgical conditions encountered amongst patients. The book is divided into five sections depending on the content of the chapters comprising details of basics of investigations and intervention, common medical and surgical conditions, geriatrics and women's health, certain physiotherapy intervention strategies commonly used in medical and surgical conditions and rehabilitation. Clinical examples provide a clear understanding of the assessment and management processes. It is a unique depiction of all topics related to medical and surgical conditions.

Salient Features

- The information is presented in a well-defined manner and easily comprehensible language
- Detailed description of the physiotherapy management and techniques used in common medical and surgical conditions
- Provides variety of photographs depicting important clinical features and management strategies
- Clinical pointers have been provided for important points and clinical guidance
- Integrated evidence with clinical practice
- Clinical examples for ease of understanding
- Review questions for exam going students.

Megha Sandeep Sheth MPT (Rehabilitation) DNHE is a Lecturer at SBB College of Physiotherapy, Ahmedabad, Gujarat, India for 20 years with clinical experience of over 30 years. She has over 100 publications. Her areas of interest are research in physiotherapy and community health among others.

Priya Singh Rangey MPT (Rehabilitation) PhD Scholar is an Assistant Professor at LJ Institute of Physiotherapy, LJ University, Ahmedabad, Gujarat, India with an academic and clinical experience of 7 years. She has several publications in national and international journals.

Neeta Jayprakash Vyas PT PhD is a Professor Emeritus at Ahmedabad Institute of Medical Sciences, Ahmedabad, Gujarat, India. She has been in the field for almost 40 years and has a vast clinical and academic experience.

Srishti Sanat Sharma MPT (Community Health and Rehabilitation) PhD has an academic and clinical experience of almost 8 years. She is currently working as a Resident Physiotherapist at Physiomed Yorkdale Inc, Toronto, Canada. She is an Ex-Lecturer, CM Patel College of Physiotherapy, Gandhinagar, Gujarat, India.

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