

# Post Graduation Curriculum & Syllabus (MD Pathology)

The candidate is expected to know both the theoretical as well as practical aspects especially related to diagnosis of appropriate diseases.

## 1. Fields in which high degree of professional competence and theoretical knowledge is expected:-

### A. General Pathology:

Normal cell, tissue structure and function.

Changes in cellular structure and function in disease.

Causes of disease and its pathogenesis.

Reaction of cells, tissues, organ systems and the body as a whole to various sub lethal and lethal injury.

### B. Systemic Pathology:

The study of normal structure and function of various organ systems and the aetiopathogenesis, gross and microscopic alterations of structure and function

of these organ systems in disease. This forms the basis of Histopathology (Surgical Pathology), Cytopathology, Autopsy Pathology and clinico-pathological correlation.

### C) Haematology:

The study of Haematology includes all aspects of the diseases of the blood and bone marrow. This would involve the study of the normal and the causes of diseases and the changes thereof.

### D) Cytopathology: Exfoliative cytology & Aspiration cytology

### E) Clinical pathology –Examination & interpretation of Urine, CSF, Body fluids Semen, Stool samples.

### F) Blood banking-Grouping & Serology

## 2. Fields in which student is expected to achieve reasonable working knowledge and skills to be able to run laboratory services independently:

a) **Laboratory Medicine** (Clinical Chemistry/Clinical Biochemistry/Chemical Pathology and Microscopy/Clinical Pathology including Parasitology).

b) **Transfusion Medicine**

## 3. Fields in which student is expected to achieve general acquaintance of techniques to understand and interpret data

a) Immunopathology

b) Histochemistry

c) Immunohistochemistry

d) Cytogenetics

e) Molecular biology

f) Medical statistics

g) Electron microscopy

h) Tissue culture

i) Maintenance of records.

j) Information retrieval, Computer & Internet

### Surgical Pathology:

- The student should be able to demonstrate understanding of the histogenetic and patho-physiologic processes associated with various lesions during discussions with colleagues, clinicians, students and patients.
  - Should be able to identify problems in the laboratory and offer viable solutions.
  - Given the clinical and operative data, the student should be able to identify, and systematically and accurately describe the chief gross anatomic alterations in the surgically removed specimens and be able to correctly diagnose at least 80percent of the lesions received on an average day from the surgical service of an average teaching hospital.
    - A student will be able to demonstrate ability to perform a systematic gross examination of the tissues including the taking of appropriate tissue sections and in special cases as in intestinal mucosal biopsies, muscle biopsies and nerve biopsies, demonstrate the orientation of tissues in paraffin blocks.
    - Given the relevant clinical, operative and radiological data, the student should be able to identify and systematically and accurately describe the chief histomorphological alterations in the tissue received in the surgical pathology service. He/she should also correctly interpret and as far as possible, correlate with the clinical data to diagnose at least 90% of the routine surgical material received on an average day. He/she should be able to diagnose at least 75% of the classical lesions being commonly encountered in the surgical pathology service without the aid of the clinical data.
    - The student should know the working of the automatic tissue-processing machine and be able to verbally demonstrate his understanding of the principles of its running.
    - Process a tissue, make a paraffin block and cut sections of good quality on a rotary microtome.
      - Stain paraffin sections with at least the following:
        - (i) Haematoxylin and eosin
        - (ii) Stains for collagen, elastic fibers and reticulin
        - (iii) Iron stain
        - (iv) PAS stain
        - (v) Stains to demonstrate Acid-fast bacilli.
          - Demonstrate understanding of the principles of:
            - (i) Fixation of tissues
            - (ii) Processing of tissues for section cutting
            - (iii) Section cutting and maintenance of related equipment
            - (iv) Differential (Special) stains and their utility
              - Cut a frozen section of tissues received from the operating room for quick diagnosis, stain and interpret the slide in correlation with the clinical data provided, and correctly diagnose at least 75 per cent of the lesions within 15 minutes.

Perform fat stain on frozen section.

- Demonstrate the understanding of the utility of various immunohistochemical stains especially in the diagnosis of tumour subtypes.

### **Autopsy Pathology**

- Should be aware of the technique of autopsy.
- Should have sufficient understanding of various disease processes so that a meaningful clinico-pathological correlation can be made.
- Demonstrate ability to perform a complete autopsy independently with some physical assistance, correctly following the prescribed instructions. Identify and correctly diagnose at least 90% of the microscopic lesions found in most autopsies, and be able to correlate the pathologic changes with the patient's clinical history and events of a few days preceding death. In exceptional circumstances, help of a frozen section may be obtained.
- Write correctly and systematically Provisional and Final Anatomic Diagnosis reports (on gross and microscopy respectively), the major findings at autopsy, and the Autopsy Protocol as per prescribed instructions, of a standard fit for an international journal.

### **Cytopathology**

- Should possess the background necessary for the evaluation and reporting of Cytopathology specimens.
  - Demonstrate familiarity with, and guide the clinical residents in the following keeping in view the special requirements of each case (Cyto-hormonal status, malignancy, infection, etc.)
    - (i) Choice of site from which smears may be taken (as in the case of vaginal smears)
    - (ii) Type of smear (morning specimen, pre-menstrual specimen, etc.)
    - (iii) Method of obtaining various specimens (urine sample, gastric smear, colonic lavage etc.)
      - Independently prepare and stain good quality smears for cytopathologic examination and be conversant with the principles and preparation of solutions of stains.
      - Demonstrate conversance with the techniques for concentration of specimens: i.e. various filters and cytocentrifuge
        - Independently be able to perform fine needle aspiration of palpable superficial lumps in patients; make good quality smears, and be able to decide on the type of staining a given case.
        - Given the relevant clinical data, he/she should be able to independently and correctly:
          - (i) Evaluate hormonal status in all cases as may be required.
          - (ii) Diagnose the status of malignancy or otherwise in at least 75% of the cases received in a routine laboratory and categorize them into negative, inconclusive and positive.

- (iii) Demonstrate ability in the technique of screening and dotting the slides for suspicious cells.
- (iv) Indicate correctly the type of tumour, if present, in at least 75% cases.
- (v) Identify with reasonable accuracy the presence of organisms, fungi and parasites in at least 75% of cases.

### **Hematology**

- Should demonstrate the capability of utilizing the principles of the practice of hematology for the planning of tests, interpretation and diagnosis of diseases of blood and bone marrow.
- Should be conversant with various equipments used in the Hematology laboratory.
- Should have knowledge of automation and quality assurance in Haematology.
- Correctly plan a strategy of investigating at least of the cases referred for special investigations in the Hematology Clinic and give ample justification for each step in consideration of the relevant clinical data provided.
- Correctly and independently perform the following special tests, in addition to doing the routine blood counts:
  - (i) Haemogram including Reticulocyte and Platelet counts.
  - (ii) Bone marrow staining including stain for iron
  - (iii) Blood smear staining
  - (iv) Cytochemical characterization of leukemia with special stains like Peroxidase, Leukocyte Alkaline Phosphatase (LAP), PAS, Sudan Black, etc
  - (v) Osmotic fragility
  - (vi) Fetal Haemoglobin
  - (vii) Sickling phenomenon
  - (viii) Bleeding time
  - (ix) Clotting time
  - (x) Prothrombin time (PT)
  - (xi) Activated partial thromboplastin time (APTT)
  - (xii) Haemoglobin electrophoresis
  - (xiii) Coombs Test
  - (xiv) Clot Solubility Test
- Demonstrate familiarity with the principle and utility in diagnosis and interpretation of results of the following:
  - (i) Red cell indices
  - (ii) Plasma haemoglobin
  - (iii) Haemosiderin in urine
  - (iv) Presumptive tests for complete antibodies

- (v) Serum electrophoresis
- (vi) Platelet function tests including platelet aggregation and adhesion and PF3 release
- (vii) Coagulation Factor assays.
- (viii) Fibrin Degradation products (FDP), D- Dimer
- (ix ) Tests for thrombosis: Lupus anticoagulant (LAC), Anticardiolipin Antibody (ACA), Activated Protein C Resistance (APCR), Protein C (Pr C), Protein S (Pr S), Antithrombin III (AT III)
- (x) Serum ferritin
- (xi) Serum iron and total iron binding capacity
- (xii) Immunophenotypic typing of leukemias
- (xiii) Cytogenetics
  - Perform a successful bone marrow aspiration/iliac crest biopsy and stain the peripheral and bone marrow smears with Romanowsky stains.
  - Describe accurately the morphologic findings in the peripheral and bone marrow smears, identifying and quantitating the morphologic abnormalities in disease states and arriving at a correct diagnosis in at least 90% of the cases referred to the Haematology clinic, given the relevant clinical data.
  - Posses working knowledge of the following:
    - (i) Bone marrow transplantation
    - (ii) Prenatal diagnosis of genetic haematological diseases
    - (iii) Molecular biology of haematological diseases

### **Laboratory Medicine**

- Demonstrate familiarity with the normal range of values of the chemical content of body fluids, significance of the altered values and interpretation thereof.
- Possess knowledge of the principles of following specialized organ function tests and the relative utility and limitations of each and significance of the altered values.
- (i) Renal function test
- (ii) Liver function test

(iii) Gastric and Pancreatic function

(iv) Endocrine function test

(v) Tests for malabsorption

- Explain the biochemical principles involved in the above estimations.

Know the principles, advantages and disadvantages scope and limitation of Automation in laboratory.

- Learn the principles and methodology of quality control in laboratory.
- Plan a strategy of laboratory investigation of a given case, given the relevant clinical history and physical findings in a logical sequence, with a rational

explanation of each step. Should be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.

- Demonstrate familiarity with and successfully perform a routine Urinalysis including Physical, Chemical and Microscopic, examination of the sediment.
- Demonstrate familiarity with and successfully perform the macroscopic and microscopic examination of Faeces and identify the ova and cysts of common parasites.
- Independently and successfully perform a complete examination; physical, chemical and cell content of Cerebrospinal Fluid (C.S.F). , Pleural and Peritoneal fluid.

• Successfully perform an examination of Peripheral Blood for the commonly occurring parasites.

- Independently perform a Semen analysis.
- Independently and correctly perform at least the following Quantitative

Estimations by Manual Techniques and/or Automated Techniques.

(i) Blood urea

(ii) Blood sugar

(iii) Serum Proteins total & fractional

(iv) Serum Bilirubin total & fractional

(v) Serum amylase

Demonstrate familiarity with the following Quantitative Estimations by Automated Techniques.

(i) Serum cholesterol

(ii) Uric acid

(iii) Serum Transaminases (ALT and AST/SGOT and SGPT)

(iv) Serum Alkaline Phosphatase

(v) Creatinine

(vi) Serum calcium and phosphorous

(vii) Serum Electrolyte (Na<sup>+</sup> and K<sup>+</sup>)

- Demonstrate familiarity with:

(i) Determination of bicarbonates

(ii) Blood gas analysis.

- Prepare standard solutions and reagents relevant to the above tests, including the preparation of normal solution, molar solution and Buffers.

- Explain the principle of Instrumentation, use and application of the following instruments.

(i) Photoelectric colorimeter

(ii) Spectrophotometer

(iii) pH meter

(iv) Flow cytometer

(v) Centrifuge

(vi) Analytical balance

(vii) Electrophoresis apparatus

(viii) ELISA Reader

(ix) Blood gas analyser

### **Transfusion Medicine (Blood Banking)**

It is expected that students should possess knowledge of the following aspects of Transfusion Medicine.

1. Basic immunology
2. ABO and Rh groups
3. Clinical significance of other blood groups
4. Transfusion therapy including the use of whole blood and RBC concentrates.
5. Blood component therapy.
6. Rationale of pre-transfusion testing.
7. Infections transmitted in blood.
8. Adverse reactions to transfusion of blood and components
9. Quality control in blood bank

It is expected that the student shall correctly and independently perform the following.

1. Selection and bleeding (Tapping) of blood donors.

2. Preparation of blood components i.e. Cryoprecipitates, Platelet concentrate, Fresh Frozen Plasma, Single Donor Plasma, Red Blood Cell concentrates.
3. ABO and Rh grouping.
4. Resolving ABO grouping problems by secretor status in saliva & expanded Panel.
5. Demonstrate familiarity with Antibody screening by
  - (i) LISS (Low-ionic salt solution)
  - (ii) Enzymes
  - (iii) AHG (Anti-Human Globulin)Steps to be taken if the above are positive.
6. Demonstrate familiarity with Crossmatching by
  - (i) LISS (Low-ionic salt solution)
  - (ii) Enzymes
  - (iii) AHG (Anti-Human Globulin)Steps to be taken if there is incompatibility.
7. Demonstrate familiarity with Antenatal and Neonatal work
  - (i) Direct antiglobulin test
  - (ii) Antibody screening and titre
  - (iii) Selection of blood for exchange transfusion
8. Demonstrate familiarity with principle and procedures involved in
  - (i) Resolving ABO grouping problems.
  - (ii) Identification of RBC antibody.
  - (iii) Investigation of transfusion reaction.
  - (iv) Testing of blood for presence of
    - (a) HBV (Hepatitis B Virus Markers).
    - (b) HCV (Hepatitis C Virus Markers)
    - (c) HIV (Human Immunodeficiency Virus Testing)
    - (d) VDRL

### **Basic Sciences (in relation to Pathology)**

#### **1. Immunopathology**

- (i) Demonstrate familiarity with the current concepts of structure and function of the immune system, its aberrations and mechanisms thereof.
- (ii) Demonstrate familiarity with the scope, principles, limitations and interpretations of the results of the following procedures employed in clinical and experimental studies relating to immunology.



- (a) ELISA techniques
- (b) Radioimmuno assay
- (c) HLA typing
- (iii) Perform and interpret simple immunological tests used in diagnosis of diseases and in research procedures.

(iv) Demonstrate familiarity with interpretations of the results

- (a) Anti-nuclear Factor (ANF)
- (b) Anti-neutrophil cytoplasmic antibody (ANCA)

## **2. Electron Microscopy**

Demonstrate familiarity with Principles and techniques of electron microscopy and the working of an electron microscope (including Transmission and Scanning Electron microscope: TEM and SEM)

## **3. Enzyme Histochemistry**

(i) Should be familiar with the principles, use and interpretation of common enzyme histochemical procedures (Alkaline Phosphatase, Acid Phosphatase, Glucose-6-Phosphate Dehydrogenase, Succinyl Dehydrogenase, Chloroacetate Esterase, Gamma-glutamyl Transpeptidase and Acetyl Cholinesterase).

(ii) Operate the cryostat, and demonstrate familiarity with the principles of its working and be able to stain tissue sections for some cell constituents.

(iii) Demonstrate familiarity with the commonly used enzyme histochemical procedures.

## **4. Immunohistochemistry**

(i) Demonstrate familiarity with the principles and exact procedures of various immunohistochemical stains using both PAP (Peroxidase-Antiperoxidase) and ABC (Avidin-Biotin Conjugate) Systems; employing monoclonal and polyclonal antibodies.

(ii) Be able to perform immunohistochemical staining using paraffin section with at least one of the commonly used antibodies (*Cytokeratin or LCA*) using PAP method.

## **5. Molecular Biology**

(i) Should understand the principles of Molecular biology especially related to the understanding of disease processes and its use in various diagnostic tests.

(ii) Should be conversant with the steps of a Polymerase Chain Reaction (PCR) and should demonstrate understanding of the steps and principles of interpretation of Western Blot, Southern Blot, Northern Blot and Hybridisation procedures.

#### **6. Principles Of Medical Statistics**

Demonstrate familiarity with importance of statistical methods in assessing data from patient material and experimental studies e.g., correlation coefficients, expected versus observed, etc. and their interpretation.

**7. Tissue Culture-** Demonstrate familiarity with methods of tissue culture.

**8. Cytogenetics-** Demonstrate familiarity with methods of Karyotyping and Fluorescent in-situ Hybridisation (FISH).