Curriculum

DNB Broad Specialty

Pathology

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I. PROGRAMME GOALS AND OBJECTIVES

1. PROGRAMME GOAL

The goals of the course are to produce a specialist who is competent professional independently and as a part of clinical team

a. To provide laboratory based diagnosis of illness,
b. Is able to teach medical, paramedical and allied undergraduates and to a certain extent postgraduate
c. Should have an idea regarding the planning of research and should be well conversant with emerging technology in the field of diagnostics, able to lead the team of laboratory personnel

2. PROGRAMME OBJECTIVES

a. Establish good pathology services in a hospital and in the community in the field of histopathology, heamatopathology, immunopathology, surgical pathology, cytopathology, clinical pathology, clinical biochemistry, as well as blood banking.
b. Plan, execute and evaluate teaching assignments in pathology, should be able to teach medical, paramedical and allied personnel
c. Capable of offering a high-quality diagnostic opinion in a given clinical situation with an appropriate and relevant sample of tissue, blood, body fluid, etc. for the purpose of diagnosis and management of the ill.
d. Able to make independent decisions in diagnostic histopathology, hematology, cytology, clinical pathology and immunology.
e. Able to teach and share his knowledge and competence with others. Should be conversant in modern methods of medical education and teaching.
f. Should be familiar with current developments and advances in the field of pathology.
g. Capable of pursuing clinical and laboratory-based research.
h. Should acquire the competence pertaining to instrumentation and procedures required for the practice of Pathology in the community and at all levels of health care system.
i. Should acquire skills effectively in communicating the diagnosis to the patients including cancer patients. He should be able to demonstrate empathy and have a humane approach towards patients and their families and respect their sensibilities.

j. Demonstrate communication skills of a high order in explaining management and prognosis, providing counseling and giving health education messages to patients, families and communities.

k. Practice the specialty of Pathology in keeping with the principles of professional ethics, should know legal aspects of establishment acts and rules of regulatory bodies of state/ nation

l. Function as a productive member of a team engaged in health, research and education.

m. Acquire knowledge of Bio-safety, skills to insulate the lab against bio-hazards

3. SPECIFIC LEARNING OBJECTIVES

a. Cognitive Domain

- Diagnose routine and complex clinical problems on the basis of Histopathology (Surgical Pathology) and Cytopathology specimens. Blood and Bone Marrow examination (Hematology) and various tests under the domain of Laboratory Medicine including Clinical Pathology, clinical Biochemistry, Chemical Pathology as well as Blood Banking / Transfusion medicine, genetics and molecular pathology
- Interpret clinical and laboratory data with reasonable accuracy.
- Able to correlate clinical and pathology data so that various clinical signs, symptoms and manifestations of disease can be correlated and explained.
- Advice on the nature of appropriate specimens and the tests necessary to arrive at diagnosis in a difficult or problematic case.
- Able to correlate clinical and laboratory findings with pathology findings at autopsy and identify the cause of death to the extent possible.
- Able to teach medical, paramedical and allied undergraduates and to a certain extent postgraduate
- Carry out research using basic research methodology so that they can conduct fundamental and applied research.
- Maintain accurate records of tests and their results for reasonable periods of time so that these may be retrieved as and when necessary as per national/state regulatory body guidelines if available.
- Make and record observations systematically that is of use of archival purposes and for furthering the knowledge of Pathology.
- Able to systematically write a paper and publish in a scientific peer-reviewed journal
- Should be aware for latest updated guidelines /formats of national /international bodies or associations for reporting

- Able to present a paper in a conference through an oral presentation and poster presentation.
- Should be able to identify problems in the laboratory and offer solutions thereof so that a high order of quality control is maintained.
- Should be capable of effectively disposing laboratory waste to ensure minimization of risk to infection and accidents to laboratory personnel as per latest WHO bio medical waste management guidelines
- Able to supervise and work with subordinates and colleagues in a laboratory.
- Subject to continuing education and constantly update their knowledge of recent advances in Pathology and allied subjects.
- Develops skills as a self-directed learner, recognize continuing educational need, use appropriate learning resources, and critically analyze published literature in order to practice evidence-based pathology.
- Demonstrates competence in basic concepts of research and epidemiology.
- Can organize and supervise the desired managerial and leadership skills.
- Develops awareness of professional ethics, medico legal aspects, Establishment Act and Rules and Regulation as legislative time to time

b. Psychomotor Domain

- Able to perform most of the tests in a Pathology Laboratory, grossing of specimens, processing, cutting of paraffin sections and staining; should be familiar with making frozen sections and staining.
- Able to collect specimens by routinely performed non-invasive out-patient procedures such as venepuncture, finger-prick, fine needle aspiration cytology of palpable lumps and bone-marrow aspirates after taking consent, staining of blood and bone marrow smears
- Should be able to integrate with team for performing an invasive procedure such as a biopsy or an imaging guided biopsy. It is implied that the complications of these procedures and handling of complications are well understood.
- Perform an autopsy; dissect various organ complexes and display of gross findings.
- Should be familiar with the function, handling and routine care of equipment in the laboratory and biomedical waste disposal.
- Ensure quality assurance in the lab as per accepted guidelines

- Should be able to comprehend ethical and legal issue and ensure compliance in the lab and Establishment Act as per rules and regulation
- Should be able to format reports as per national and international bodies/association guidelines, should be aware of the latest guidelines regarding formulation of comprehensive reports
- Should be able to comprehend ethical and legal issues, medico legal aspects, Establishment Act and Rules and Regulation as legislative time to time

c. Affective Domain

- Should be able to function as a part of a team that is essential for the diagnosis and management of a patient. Should therefore develop an attitude of cooperation with colleagues necessary for this purpose. It is implied that whenever necessary interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel.
- Respect the rights of the patient including the right to information and second opinion.
- Should seek second opinion where necessary and give second opinion only when requested.
- Provide leadership and inspire members of the team involved with in the fields of diagnostic pathology, teaching and research.
- Develop communication skills not only to word reports and professional opinions but also to interact with patients, relatives, peers and paramedical staff.
- Quality assurance in labs accreditation.

II. TEACHING AND TRAINING ACTIVITIES

The fundamental components of the teaching programme should include:

1. Case presentations & discussion- once a week
2. Seminar – Once a week
3. Journal club- Once a week
4. Grand round presentation (by rotation departments and subspecialties)- once a week
5. Faculty lecture teaching- once a month

6. Clinical Audit-Once a Month
7. A poster and have one oral presentation at least once during their training period in a recognized conference.

The rounds should include bedside sessions, file rounds & documentation of case history and examination, progress notes, round discussions, investigations and management plan) interesting and difficult case unit discussions.

The training program would focus on knowledge, skills and attitudes (behavior), all essential components of education. It is being divided into theoretical, clinical and practical in all aspects of the delivery of the rehabilitative care, including methodology of research and teaching.

Theoretical: The theoretical knowledge would be imparted to the candidates through discussions, journal clubs, symposia and seminars. The students are exposed to recent advances through discussions in journal clubs. These are considered necessary in view of an inadequate exposure to the subject in the undergraduate curriculum.

Symposia: Trainees would be required to present a minimum of 20 topics based on the curriculum in a period of three years to the combined class of teachers and students. A free discussion would be encouraged in these symposia. The topics of the symposia would be given to the trainees with the dates for presentation.
Clinical: The trainee would be attached to a faculty member to be able to pick up methods of history taking, examination, prescription writing and management in rehabilitation practice.

Bedside: The trainee would work up cases, learn management of cases by discussion with faculty of the department.

Journal Clubs: This would be a weekly academic exercise. A list of suggested Journals is given towards the end of this document. The candidate would summarize and discuss the scientific article critically. A faculty member will suggest the article and moderate the discussion, with participation by other faculty members and resident doctors. The contributions made by the article in furtherance of the scientific knowledge and limitations, if any, will be highlighted.

Research: The student would carry out the research project and write a thesis/ dissertation in accordance with NBE guidelines. He/ she would also be given exposure to partake in the research projects going on in the departments to learn their planning, methodology and execution so as to learn various aspects of research.

Rotation Posting: During the tenure of 3 years training, the candidate should be posted on rotation in various departments in the same institution or other institutions. The duration of posting in different departments will be minimum of 15 days and maximum of 3 months in one schedule, as per availability of different services and mutual agreement between heads of the departments/ institutions.

A structured scheme of training is recommended so that every student is exposed to different aspects of the subject and acquires sufficient knowledge and skill as expected from the course. The method by which this is done may vary from institution to institution. It is suggested that one senior member of the faculty be given the chief responsibility for organizing and coordinating this program and ensuring the prescribed guidelines from him/her. The three-year training program for the DNB degree may be arranged in the form of postings to different assignments/ laboratories for specified periods as outlined below. The period of such assignments/postings is recommended for 35 months.

The trainees are rotated in sections of surgical pathology, hematology, cytology and lab medicine in all the three years, trainee should also be provided sufficient time as per requirement for plan submission, protocol, collection of data, analysis and writing dissertation.

Recommended rotation schedule

Section	**Months**
Surgical Pathology and Techniques	12
Autopsy, Postmortem Techniques and Museum	1
Hematology	6
Cytopathology	4
Thesis/Dissertation Work/ Basic Sciences including Immunopathology, Electronmicroscopy,	4

Molecular Biology, Research Techniques etc	
Laboratory Medicine	4
Transfusion Medicine/Blood Bank	2
Elective/reorientation	2
Total	35

III. SYLLABUS

The Study of Pathology includes all aspects of pathology including surgical pathology, cytology, Hematology, Lab medicine, immunology and Transfusion Medicine.

The syllabus would also include the principle and practice of pathology and its applied aspects and essential of Transfusion Medicine.

General Pathology

Normal cell and tissue structure and function. The changes in cellular structure and function in diseases. Causes of disease, its pathogenesis, reaction of cells, tissues, organ systems and the body as a whole to various sub lethal and lethal injuries.

Cellular adaptation cell injury and cell death

- Mechanism, morphology and examples of cell injury, necrosis and apoptosis.
- Sub cellular and cellular responses and adaptation to injury
- Intracellular and intercellular accumulations, pathological calcification and cell aging.

Acute and chronic inflammation

- Vascular and cellular events in acute inflammation, chemical mediators, outcome and morphological patterns of acute inflammation.
- Chronic inflammation with special reference to granulomatous inflammation.
- Systemic effects and effects of deranged inflammation.

Tissue renewal and repair: Regeneration healing and fibrosis.

- Control of normal cell proliferation and tissue growth, mechanism of tissue regeneration, repair by healing and fibrosis.

- Extracellular matrix and cell matrix interactions.

Hemodynamic disorders, thrombo embolic disease and shock.

- Edema, hyperemia, congestion and haemorrhage.
- Normal Hemostasis, thrombosis, DIC, embolism, infarction and shock.

Genetic Disorders

- Principles of genetics, normal karyotyping.
- Mutations, Mendelian disorders, disorders with multifactoral inheritance cytogenetic disorders involving autosomes and sex chromosomes.
- Single gene disorders with nonclassic inheritance.
- Diagnosis of genetic disorders involving molecular and genetic techniques.

Neoplasia

- Definition, nomenclature and biology of tumor growth.
- Molecular basis of cancer with special reference to carcinogenic agents and molecular basis of multistep carcinogenesis
- Epidemiology and clinical features of tumors.
- Grading, staging and laboratory diagnosis of cancer.

Infectious Diseases

- Pathology and general principles of microbial pathogenesis, special techniques for diagnosing bacterial, fungal, parasitic and viral infections.

Environmental and nutritional pathology

- Common environmental and occupational exposures leading on to diseases.
- Nutritional deficiencies and obesity related disorders.

Disease of Infancy and Childhood

- Congenital anomalies, birth injuries, diseases of neonates, inborn errors of metabolism, tumor and tumor like lesions of infancy and childhood.

Immunopathology

- Innate immunity- Role of phagocytic cells, complement, mast cells & humoral mechanisms
- Specific Acquired Immunity- Details about antibody production & action, Brief principles about memory, Ag specificity & vaccination

- Cell involved in Immune response- T- Lymphocytes, B- lymphocytes, macrophages, dendritic cells and natural-killer cells
- Cytokines with details about their properties and functions
- Structure and function of histocompatibility molecules and disease association
- Disorders of the immune system
  - All hypersensitivity reactions
  - Autoimmune disorders with special reference to SLE, Rheumatoid arthritis, Sjogren's syndrome, systemic sclerosis, polyarteritis nodosa and other vasculitides, Mixed connective tissue disorders and inflammatory disorders.
  - Immunodeficiency syndrome – Acquired with emphasis on AIDS
- Amyloidosis including pathogenesis, special stains & clinical correlation
- Transplant rejection in detail
- Graft Vs Host Disease

General principles of techniques and instrumentation

Systemic Pathology

Histopathology, Hematology, Cytology, Lab Medicine and Transfusion Medicine

- The student should be able to comprehend the histogenetic and patho-physiologic processes, demonstration of morphology (gross and microscopic) 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
- Comprehend principles and procedure of lab techniques and trouble shooting

Blood vessels, lymphatic and veins

- Normal morphology, congenital anomalies, atherosclerosis, hypertensive vascular disease.
- Inflammatory and neoplastic diseases of all the vessels.

Heart

- Normal morphology, its blood supply and effect of aging on heart.

- Ischemic
- Hypertensive, valvular, congenital heart diseases
- Cardiomyopathies
- Myocardial disorders
- Pericardial diseases.
- Tumors of the heart.

Lungs and Mediastinum

- Congenital anomalies
- Obstructive and restrictive pulmonary diseases.
- Diseases of vascular origin.
- Infections of Lung
- Infections of Mediastinum
- Tumors of lung
- Lung transplantation
- Diseases of pleura.
- Thymus – Developmental, autoimmune and inflammatory disorder and tumors.

Head and Neck

- Oral cavity: - inflammatory disease, Preneoplastic lesions and tumors
- Diseases of teeth and supporting structures.
- Upper airways and ear – congenital anomalies, infections and tumors.
- Salivary glands – Infections autoimmune disorders and tumors.

Gastro Intestinal Tract

- Congenital anomalies, infections, inflammatory and vascular disorders and tumors of esophagus, stomach, small and large intestines, appendix and anal canal.
- Diseases of the peritoneum, Omentum and Mesentry

Retroperitoneum

- inflammatory and neoplastic lesions

Liver

- Normal morphology with general features of hepatic disease including LFTs.

- Infectious, autoimmune drug induced metabolic and circulatory disorders of liver.
- Hepatic diseases associated with pregnancy, neonates organ and bonemarrow transplantation.
- Liver transplantation pathology
- Cysts, Nodules and tumors of liver.

Biliary tract

- Congenital anomalies, injuries, Infection, inflammation, of Gallstones and tumors of gall bladder and extra hepatic bile ducts.

Pancreas

- Congenital anomalies, pancreatitis and neoplasms of pancreas.

Kidney

- Clinical manifestations of renal diseases
- Congenital anomalies
- Diseases affecting glomeruli, tubules, interstitium and blood vessels.
- Cystic diseases of kidney
- Nephrolithiasis
- Tumors of kidney
- Kidney Transplant pathology

Lower urinary tract and male genital system

- Congenital anomalies, inflammation and tumors of ureter, urethra, penis, testis, epididymis and Scrotum
- Inflammation, enlargement and tumors of prostate.

Female genital tract

- Physiology, cytology and histology of female genital tract, menstrual disorders and hormonal abnormalities
- Congenital anomalies, inflammation, preneoplastic and neoplastic lesions of vulva, vagina, cervix, uterus, fallopian tubes, ovaries and mesonephron
- Gestational and placental disorders.

Breast

- Inflammations, benign epithelial lesions and tumors of the breast.
- Diseases of male breast.

Endocrine System

- Normal hormonal levels and functions of all the endocrine glands.
- Hypo and hyperactivity of glands of endocrine system i.e. pituitary, thyroid, parathyroid, pancreas, adrenals and pineal gland.
- Autoimmune diseases, inflammations and tumors affecting these glands.
- Neuroendocrine tumors

Skin and Subcutaneous tissue

- Disorders of pigmentation and melanocytes
- Inflammatory, vesiculobullous and infectious disease
- Proliferative lesions and Tumors of the epidermis, dermis and skin appendage.

Musculoskeletal system

- Bone Modelling, growth and development, genetic and acquired abnormalities in bone cells, matrix and structure, factures, necrosis and infections of bones, tumors and tumor like lesions.
- Joints: Arthritis, tumor and tumor like lesions.
- Soft tissue: Tumors and tumor like lesions

Peripheral nerves and skeletal muscles

- General reactions of motor units
- Inflammatory, infectious, hereditary, metabolic and traumatic neuropathies
- Atrophy, dystrophy, myopathies of the skeletal muscles
- Diseases of neuromuscular junction
- Tumors of peripheral nerves and skeletal muscles

Skull and Central Nervous System

- Degenerative, metabolic, toxic, demyleinating, infectious, cereberovascular malformations and traumatic injuries
- Tumors

Eye and Orbit

- Infections, inflammatory, congenital diseases and neoplasms of orbit, eyelid, conjunctiva sclera, uvea, cornea, retina and optic nerves

Biology of stem cell and Hematopoiesis

- Overview of stem cell biology and cellular biology of haematopoiesis.
- Transcription factors and humoral regulation in normal and malignant haematopoiesis.
- Interaction between haematopoietic stem cells, progenitor cell and stromal compartment of bone marrow.
- Stem cell homing & mobilization.

Erythroid maturation, differentiation and abnormality

Pathobiology of human erythrocyte & Hemoglobin Anemia

- Approach to anaemia in adults and children in: Clinical correlation & diagnostic modalities.
- Classification of anaemias (Morphological, pathophysiological and based on erythropoiesis ie Proliferative vs non-proliferative)
- Iron deficiency anaemia including iron metabolism and differential diagnosis from other microcytic hypochromic anaemias.
- Disorder of iron metabolism including iron overload.
- Anaemia of chronic disorders with special reference to infections, collagen vascular disorders, inflammation etc.
- Megaloblastic anaemia and other causes of megaloblastosis.
- Definition, approach and classification of haemolytic anaemia
- lab diagnosis of Haemoglobin disorders and hereditary anemia like Thalassemia and related hemoglobinopathies, sickle cell anaemia, Haemoglobin associated with altered Oxygen affinity.
- Red blood cell enzymopathy, membrane disorder, autoimmune hemolytic anaemia, non-immune hemolytic anaemia, paroxysmal nocturnal haemoglobinuria.
- Approach to Pancytopenia/ Cytopenias
- Bone marrow failure syndrome
- Porphyrias

WBC disorders, complement and immunoglobin biology

- Normal granulopoiesis
- Acquired and congenital disorders of phagocytosis (neutrophil, monocyte, eosinophil and macrophages
- Disorder of leukocyte number, function and morphology
- Storage disorder

- Hematological responses to Viral disorders (Infectious mononucleosis, Hepatitis and dengue) and parasitic infections (Malaria, Kala azar)

Haemotological malignancies

- Conventional & molecular cytogenetic and immunohistochemical basis of haematological malignancies.
- Classification (FAB, WHO). Their basis and diagnostic approach to various haematological malignancies.
- Pathophysiology, prognostic factors, cytochemistry, cytogenetics of various leukaemias
- Pathophysiology and classification of MDS, MPN/MDS, myeloproliferative disorders
- Pathophysiology of Non-Hodgkin's lymphoma, Clinical staging of Hodgkin's lymphoma. Role of molecular cytogenetics and immunohistochemistry in Hodgkin's and Non-Hodgkin's lymphoma and lymphoproliferative disorders.
- AIDS related and Transplant related lymphomas.
- Plasma cell dyscrasias and gamaopathies
- Mastocytosis
- Role of chemotherapy and antineoplastic agents based on molecular mechanism of haemotological malignancies, clinical use of haematopoietic growth factors.

Haematopoietic stem cell transplantation

- Role and indications of HST
- Immunodeficiency state, Genetic disorders haematological Malignancies and Non-haematological disorders.
- Practical aspect of umbilical cord stem cells transplantation. Peripheral stem cell collection.
- Role of stem cell in tissue repair. Complications of Haematopoietic stem cell transplant.

Gene therapy and genetic engineering

Hemostasis & Thrombosis

Megakaryocyte and platelet structure. Molecular basis of platelet function, activation. Role of blood vessel, coagulation system and fibrinolytic system in haemostasis.

- Clinical and lab evaluation of bleeding and coagulation disorders.
- Clinical & diagnostic aspects of:
  - Factor deficiencies including haemophilia, von Willebrand disease, DIC, Vitamin K deficiency
  - Thrombotic and non-thrombotic purpura
- Hereditary and acquired platelet disorders and its management
- Thrombophilia (Inherited & acquired) and Lab evaluation and management of hypercoagulable states

Human blood group antigen and antibody and Immuno-hematology

- Selection of donor and screening
- Principle, indication and storage of red blood cells, WBC, platelet and plasma transfusion
- Various methods of component separation and plasma derivatives with special reference to Fresh frozen plasma, cryo-precipitates, albumin and Immunoglobulin
- Graft Rejection, GVH diseases, Transfusion Reactions, Blood grouping & cross matching
- Blood bank audit
- Apheresis

Hematological manifestations of systemic diseases like liver disorders, renal disorders, infections, cancers, parasitic diseases, AIDS, pregnancy and surgical patients

Spleen and its disorders

Current topics and recent advances in pathology

Quality assurance program

Establishment Act and Rules and Regulation formed by Govt. or regulatory bodies

Biomedical Waste Management

Biostatistics, Research Methodology and Clinical Epidemiology Ethics

Medico legal aspects relevant to the discipline

Health Policy issues as may be applicable to the discipline

IV. COMPETENCIES

1. 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 80 percent of the lesions received on an average day from the surgical service of an average teaching hospital.
2. A student will be able to demonstrate ability to perform a systematic gross examination of the tissues including the taking of appropriate tissue section and in special cases as in intestinal mucosal biopsies, muscle biopsies, and nerve biopsies, demonstrate the orientation of tissues in paraffin blocks.
3. Given the relevant clinical, operative and radiological data, the student should be able to identify and systematically and accurately describe the morphological findings. 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.
4. 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.

Histopathology

Histological techniques

- Principles and procedures of grossing
- Fixation and fixatives
- Tissue processing and microtomy
- Staining and its interpetation
- Details of haematoxylin and eosin stain
- Principles of special stains used in histopathology with their practical applications
- Processing of bones
- Immunocytochemical, enzyme, histochemistry, immunoflourescence techniques
- Details, techniques and uses of immunohistochemistry.
- Internal and external quality control and management of laboratory.

- Principles & application of all types of microscopes e.g. light, electron, fluorescence etc
- Block cutting,
- Special stains
  - Collegen, and elastin
  - PAS stain
  - ZN stain/ Wade fite
  - Reticulin stain
  - Masson's trichrome stain
  - Amyloid, calcium, Iron and Fat and other pigments
  - Intraoperative consultation including frozen/ Imprint /Squash and scrape preparation

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 protocols. Correctly identify all major lesions which have caused, or contributed to, the patient's death on macroscopic examination alone

- 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

- 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

- Demonstrate familiarity with methods of specimen collection, fixation and staining cytopreparation and turnaround time for common specimens.
- Cyto centrifugation
- Filtration procedures
- Principle procedures and aspiration techniques
- Processing of fluid specimens
- Preparation of cell blocks
- Routine and special Stains:
  - Pap stain
  - Ziehl Neelsen stain
  - Giemsa stain
  - H & E stain
  - Immunocytochemistry
- Knowledge of current Bethesda system for Gynae cytopathlogy.
- Knowledge of elements of adequacy, current lab reporting systems, FNAC, exfoliative non Gynae cytopathlogy specimens.
- Ancillary techniques including image analysis, immuno cytochemistry flow cytometry FISH etc.
- Principles of automated screening for Gynae cytopathlogy specimens.
- Quality control and improvement along with risk management.
- Knowledge of LBC, Thin preparation and other advancement in cytology.
- Demonstrate verbal familiarity with, and guide the clinical residents in the following, keeping in view of the special requirements of each case (cytohormonal status, malignancy, infection, etc.).
- Choice of site from which smears may be taken (as in the case of vaginal smears).
- Type of smear (morning specimen, after specimen, pre-menstrual specimen, etc.)
- Method of obtaining various specimens (urine sample, gastric smear, colonic lavage etc.)
- Guided FNAC including EUS, CT, USG, etc.
- Should have competency in history taking, preparation of patients, and interpretation of adequacy of aspirates and appropriate after care of patients.
- Independently stain good quality smears for cytopathologic examination and be conversant with the principles and preparation of solutions of stains (MCG, PAP and AFB).
- Demonstrate conversance with the techniques for concentration of specimens:
- i.e. various filters or cytocentrifuge.

- Working familiarity with instruments and materials related for FNAC, preparation of smears, proper handling for ancillary techniques.
- 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 in a given case.
- Given the relevant clinical data. Should be able to independently and correctly:
  - Evaluate hormonal status in all cases as may be required.
  - Diagnose normal reactive infectious dysplastic and neoplastic conditions and 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 or positive.
  - Demonstrate ability in the technique of screening and dotting of slides for suspicious cells.
  - Identify with reasonable accuracy the presence of organisms, fungi or parasites.

Hematology

- Should demonstrate the capability of utilizing the principles of the practice of hematology for the planning of tests, interpretation and diagnosis of disease of the blood and bone marrow.
- Should be conversant with various equipments used in the hematology laboratory.
- Should have knowledge of automation and quality assurance in hematology. Including cell counters/Coagulation analyzers, flow cytometer and others like thromboelastography, Platelet aggregometer etc.
- Correctly plan a strategy of investigating cases referred for special investigations in the Hematology clinic and give ample justification for each step in consideration of the relevant clinical data provided.
- Principle of blood collection, including knowledge and use of anticoagulants
- 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.
- Correctly and independently perform the following special tests, in addition to doing the routine blood counts:
  - Haemogram including Reticulocyte, Platelet counts , ESR and P/S making

- Perform a successful bone marrow aspiration/iliac crest biopsy and stain the peripheral and bone marrow smears with Romanowsky stains.
- Bone marrow staining including stain for iron.
- Cytochemical characterization of leukemia with special stains like Peroxidase, Leukocyte Alkaline Phosphatase (LAP), PAS, Sudan Black, Oil Red O, Acid Phosphatase (including Taratarate resistant) and non specific esterase.
- Osmotic fragility
- LE Phenomenon
- Fetal Haemoglobin
- Sickling phenomenon
- Hb Electrophoresis / Hb HPLC
- Coombs Test
- Cytochemistry and Immunocytochemistry

Screening test for bleeding disorders

- Bleeding time
- Clotting time
- Prothrombin time (PT)
- Activated partical thromboplastin time (APTT)
- Clot solubility Test
- HAM's sucroslysis Test
- Factor assays
- Tests for APLA -LA and antiphospholipid antibodies

Demonstrate familiarity with the principle and utility in diagnosis of the following:

- Red cell indices
- Plasma haemoglobin
- Haemosiderin in urine
- Presumptive tests for complete antibodies
- Serum electrophoresis
- Platelet function tests including platelet aggregation and adhesion and PF3 release
- Russell's viper venom time (RVVT)
- Coagulation Factor assays
- Screening for coagulation factor inhibitors

- Fibrin Degradation products (FDP), D-dimers
- Monitoring of anticoagulant therapy
- 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)
- Serum ferritin
- Serum iron and total iron binding capacity
- Immunopheno typing
- Cytogenetics

- Demonstrate verbally and in writing, his/her understanding of the principles of the above tests their utility in diagnosis and interpretation of results.
- Posses working knowledge of the following:
  - Bone marrow transplantation
  - Prenatal diagnosis of genetic hematological diseases
- Collection of blood samples and preparation of peripheral smears

Immunopathology & Molecular biology

Principle, Techniques & practical Applications of the following:

- Agglutination Reactions- All tests based on ELISA
- Protein electrophoresis
- Immunoelectrophoresis
- Detailed knowledge of ANA & ANCA profile
- Immunohistochemistry
- Immunoflourescence
- RIA (Radio immunoassay)
- PCR
- FISH, CISH, SKY
- Flow Cytometry
- Blot techniques
- Chemiluminiscence
- Should know the principle, technique, standardization and trouble shooting of different automated and semi automated equipments used in the molecular laboratory
- Should understand the principles of Molecular Biology especially related to the understanding of disease processes and its use in various diagnostic tests.
- 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 and other newer techniques.

- 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.
  - ELISA techniques
  - Radioimmuno assay
  - HLA typing

Laboratory Medicines

Clinical Pathology

- Complete urine examination with reference to its physical, chemical, microscopy and special tests.
- Semen examination – Physical, chemical (pH, Liquefaction time) and microscopic examination.
- Stool examination – Physical and microscopic examination
- CSF Examination and other body fluids including peritoneal, pleural,synovial and pericardial etc.

Chemistry Lab

- 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 altered values.
  - Renal function test
  - Liver function test
  - Gastric and Pancreatic function
  - Test for diagnosis, monitoring and its complications of Diabetes mellitus
  - Endocrine function test
  - Tests for mal-absorption
  - Others
- Should know the biochemical principles involved in the above estimations
- Know the principles, advantages and disadvantages scope and limitation of Automation in laboratory
- Know 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. He should be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.

- 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.
  - Photoelectric colorimeter
  - Spectrophotometer
  - pH meter
  - Flame photometer
  - Centrifuge
  - Analytical balance
  - Electrophoresis apparatus
  - Light microscope
  - Blood gas analyzer
  - Flow cytometer
  - Chemilumincense analyser
  - Other

Emergency Lab Services

- To be able to manage emergency lab services with emphasis on quick turnaround time

Transfusion Medicine / blood banking

It is expected that students should possess knowledge of the following aspects of transfusion medicine.

- Basic immunology
- ABO and Rh groups
- Clinical significance of other blood groups
- Transfusion therapy including the use of blood and its components
- Blood component therapy.
- Rationale of pre-transfusion testing.
- Infections transmitted in blood.
- Adverse reactions to transfusion of blood and components.
- Quality control in blood bank.

It is expected that the student shall correctly and independently perform the following with understanding of its

- Selection and bleeding of donors
- Preparation of blood components i.e. cryoprecipitates, Platelet concentrate, Fresh frozen plasma, Single donor plasma, Red blood cell concentrates.
- ABO and Rh grouping.
- Resolving ABO grouping problems by secretor status in saliva and expanded panel.
- Demonstrate familiarity with Antibody screening techniques
- Demonstrate familiarity with antenatal and Neonatal work
  - Direct antiglobulin test
  - Antibody screening and titre
  - Selection of blood for exchange transfusion.
- Demonstrate familiarity with principle and procedures involved in
  - Resolving ABO grouping problems.
  - Identification of RBC antibody.
  - Investigation of transfusion reaction.
  - Testing of blood for presence of TTI including
  - HBV (Hepatitis B virus markers)
  - HCV (Hepatitis C virus markers)
  - HIV (Human Immunodeficiency virus testing)
  - VDRL, Malaria
  - Others

by chemilumiscens, ELISA and NAT

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).
- Observe fixation, processing and staining of tissues for electron microscopy.
- Recognize the appearance of the normal sub-cellular organelles and their common abnormalities (when provided with appropriate photographs)

Principles of Medical Statistics and Research Methodology

- 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.
- Should be able to calculate means, standard deviation and standard error from the given experimental data
- Should be able to interpretation statistical data
- Information Related to computers, internet in medicine

Tissue Culture

Demonstrate familiarity with methods of tissue culture and it utility

Cytogenetics

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

Lab Audit: Maintenance of records

V. LOG BOOK

A candidate shall maintain a log book of operations (assisted / performed) during the training period, certified by the concerned post graduate teacher / Head of the department / senior consultant.

This log book shall be made available to the board of examiners for their perusal at the time of the final examination.

The log book should show evidence that the before mentioned subjects were covered (with dates and the name of teacher(s) The candidate will maintain the record of all academic activities undertaken by him/her in log book.

1. Personal profile of the candidate
2. Educational qualification/Professional data
3. Record of case histories

4. Procedures learnt
5. Record of case Demonstration/Presentations
6. Every candidate, at the time of practical examination, will be required to produce performance record (log book) containing details of the work done by him/her during the entire period of training as per requirements of the log book. It should be duly certified by the supervisor as work done by the candidate and countersigned by the administrative Head of the Institution.
7. In the absence of production of log book, the result will not be declared.

VI. RECOMMENDED TEXT BOOKS AND JOURNALS

1. TEXT BOOKS

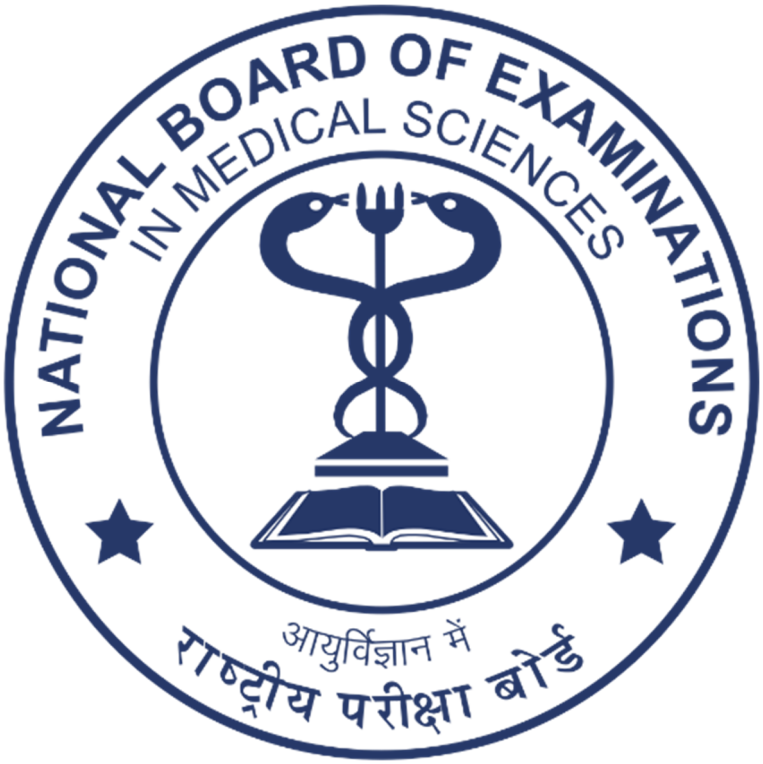
- Histology for Pathologists. Stephen S. Sternberg (Ed), Raven Press, New York.
- General Pathology JB Walter, MS Israel. Churchill Livingstone, Edinburgh
- Robbin's Pathologic Basis of Disease Ramzi S.Cotran, Vinay Kumar, Stanley L Robbins WB Saunders Co., Philadelphia.
- Pathology Emanuel Rubin, John L Farber. JB Lippincott Co., Philadelphia
- Anderson's Pathology. John M Kissane (Ed). The CV Mosby Co., St. Louis
- Ackerman's Surgical Pathology. Juan Rosai Mosby. St. Louis
- Diagnostic Surgical Pathology. Stephen S Sternberg. Lippincott, William Wilkins. Philadelphia
- Systemic Pathology. W St. C Symmers (Series Ed) Churchill Livingstone, Edinburgh
- Diagnostic Histopthology of Tumours. Christopher DM Fletcher (Ed). Churchill Livingstone. Edinburgh.
- Soft Tissue Tumors. Franz M Enzinger, Sharon W Weiss. Mosby, St. Louis
- Cardiovascular Pathology Malcolm D Silver Churchill Livingstone New York.
- Pathology of Pulmonary Diseases Mario J Saldhana. JB Lippincott Co., Philadelphia
- Basic & Advances Biostatistics - Manju Pandey
- Oxford Handbook of Medical Biostatistics
- Spencer's Pathology of the Lung. PS Hasleton. Mc Graw-Hill, New York.
- Dahlin's Bone Tumors. K Krishnan Unni. Lippincott-Raven Publishers, Philadelphia, New York
- Bone Tumours Andrew G Huvos WB Saunders Co. Philadelphia
- Greenfield's Neuropathology. J Hume Adams (Ed) Edward Arnold, London.

- Russell & Rubeinstein's Pathology of the Tumours of the Nervous System. Darrell D Bigna. Roger E Mc Lendon, Janet M Bruner (Eds.), Arnold, London
- Rosen's Breast Pathology. Paul Peter Rosen. Lippincott-Raven Publishers, Philadelphia, New York.
- Pathology of the Gastrointestinal Tract. S-I Chun Ming. Harvey Goldman (Eds.)
- Williams & Wilkins, Baltimore.
- Haynes and Taylor Obstetrical & Gynaecological Pathology. H Fox, M Wells.
- Churchill Livingstone New York.
- Heptinstall's Pathology of the Kidney. J Charles Jenette, Jean L Olson, Melvin M Schwartz, Fred G Silva (Eds.). Lippincott-Raven Publishers, Philadelphia, New York.
- Potter's Pathology of the Fetus & Infant. Enid Gilbert-Barnes (Ed). Mosby, St. Louis
- Lever's Histopathology of the Skin, David Elder (Ed), Lippincott-Raven Publishers, Philadelphia, New York
- Theory and Practice of Histological Techniques, Bancroft JD, Stevens A, Turner DR, Churchill Livingstone, Edinburgh
- Histotechnology – A Self Instructional Text, Carson FL, American Society of Clinical Pathologists, Chicago
- Histochemistry Theoretical and Applied. AG Everson Pearse. Churchill Livingstone, Edinburgh
- Manual & Atlas of Fine Needle Aspiration Cytology. Svante R Orell, Gregory F Sterrett, Max NI. Walters, Darrel Whitaker. Churchill Livingstone, London
- Cytopathology. Zuher M Naib. Little Brown and Company, Boston.
- Diagnostic Cytology and its Histopathologic Basis, Koss LG, J.B. Lippincott, Philadelphia
- Comprehensive Cytopathology, Bibbo M, W.B. Saunders Co., Philadelphia
- William's Hematology Beutler E, Lichtmann MA, Coller BS, Kipps TJ, McGraw Hill, New York
- Postgraduate Hematology Hoffbrand AV, Lewis SM, Tuddenham EGD, Butterworth Heinemann, Oxford
- Wintrobe's Clinical Hematology, Lee GR, Foerster J, Lupeus J, Paraskevas F, Gveer JP, Rodgers GN, Williams & Wilkins, Baltimore
- Practical Haematology, Dacie JV, Lewis SM, Churchill Livingstone, Edinburgh
- Bone Marrow Pathology, Bain BJ, Clark DM, Lampert IA, Blackwell Science, Oxford
- Leukemia Diagnosis- A guide to the FAB Classification, Bain BJ, J.B. Lippincott, Philadelphia

- Clinical Diagnosis and Management by Laboratory Methods, Henry JB, WB Saunders. (Indian Edition, Eastern Press, Bangalore).
- WHO fascicles of tumors of different systems

2. JOURNALS

- Indian Journal of Pathology & Microbiology
- Indian Journal of Haematology & Transfusion Medicine
- Indian Journal of Cytology
- Cytopathology
- Acta Cytologica
- Cancer
- Archives Of pathology
- British Journal Of Haematology
- American Journal Of Pathology
- Human Pathology
- Seminars in haematology
- Blood
- Histopathology
- American J of surgical pathology
- Am. J Of clinical pathology
- Diagnostic cytopathology



आयुर्विज्ञान में राष्ट्रीय परीक्षा बोर्ड

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