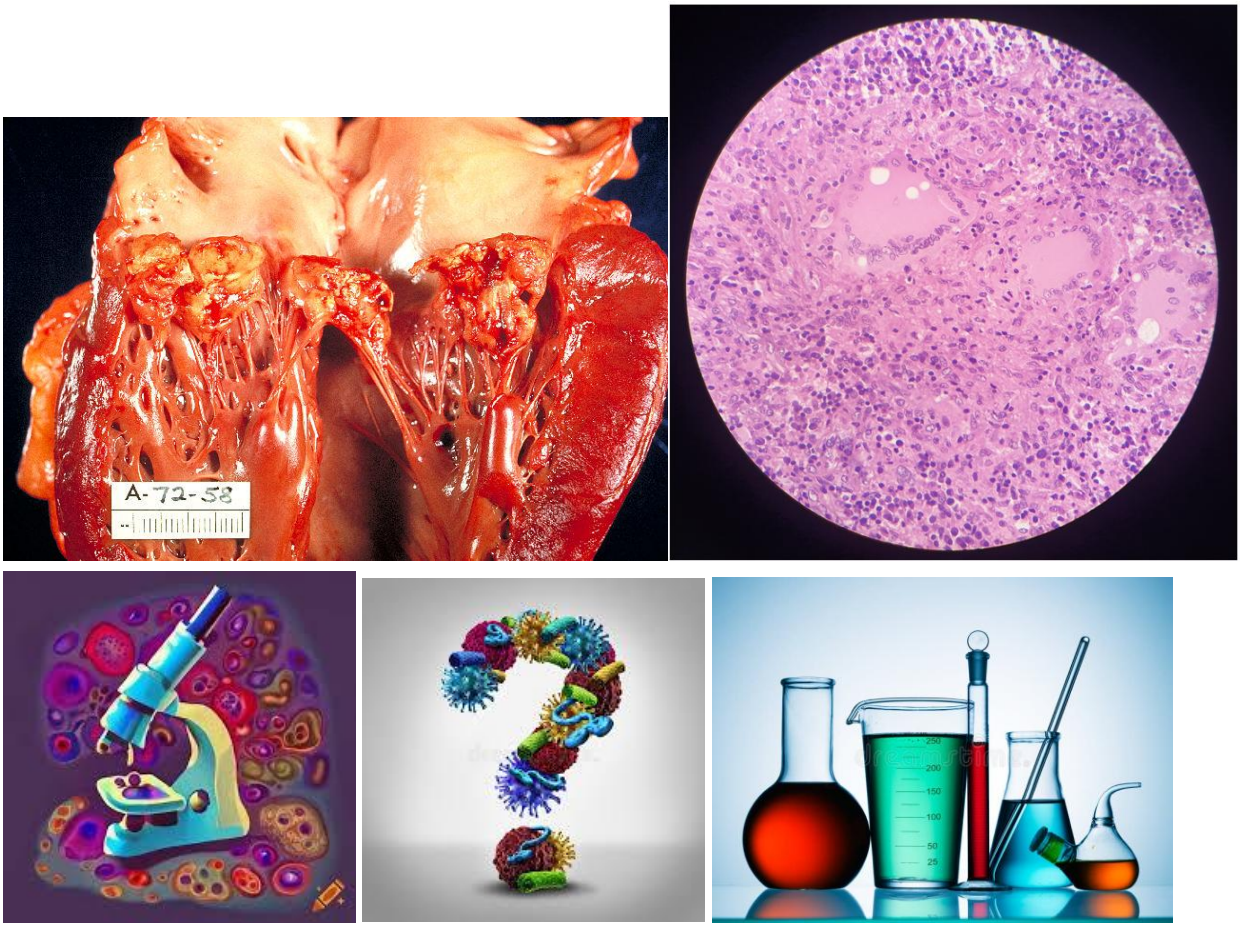
Students Handbook Pathology



Department of Pathology

Faculty of Medicine

Sabaragamuwa University of Sri Lanka

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Pathology Curriculum - An overview

- **Course title- Pathology**
- **Credit Value 09**
- **Prerequisites- Successful completion of 2nd MBBS Examination**
- **Course Aim- To enable students to bridge Clinical knowledge with the basic sicences**
- **Comprises of 4 semesters (Semester IV. V, VI, VII in academic Year 3 and 4**
- **Each semester comprises of 16 weeks**
- **Subject areas in each semester- Figure 01**
- **Course specifications- Course Learning outcomes and Intended Learning outcomes (ILOs) of each session- Please see Page 6 to 31**
- **Teaching and Learning methods:**
    - Lectures [Face-to-Face and Online]]
    - Practical sessions (virtual/Onsite)
    - Small Group Discussions (SGD) /Tutorials
    - Clinical Pathology appointment-(Hospital based) during Semester VI and VII (Please see Annexure 01 – Learning objectives for Clinical Pathology appointment.)
- **Assessments:**
    a. **Summative assessments –Continuous /In-course Assessments -At the end of each semester (Semester IV, V, VI, VII)**
    b. **Formative Assessments-At least 3 assessments per semester with immediate feedback. Conducted in the form of MCQs (T/F, SBA, EMQ) /SEQs/OSPEs**
    c. **End course assessment- 3rd MBBS Part 2 Examination (main and subsequent)**
- **Assessment structure(Summative) –mentioned below in detail.**

Assessment Structure

Continuous (In Course) Assessments

Exam	Assessment Method	Allocated Time	Marks
End of Semester 4	*20 MCQ (15 MTF type + 5 SBA)*	1 hour	3 marks
End of Semester 5	*20 MCQ (15 MTF type + 5 SBA)*	1 hour	3 marks
End of Semester 6	*20 MCQ (15 MTF type + 5 SBA)*	1 hour	7 marks
End of Semester 7	*20 MCQ (15 MTF type + 5 SBA)*	1 hour	7 marks
Total			**20 marks**

End of Course Assessments (3rd MBBS Part 2 main and subsequent Examination)

Exam	Assessment Method	Allocated Time	Marks
Written Paper I	15 MTF type MCQ + 3 SBA + 3 EMQ with 4 scenarios each	1 hour 45 min	25 marks
Written Paper II	6 SEQ	1.5 hours	25 marks
OSPE	25 stations	4 min each	30 marks
Contribution from Continuous Assessments*			20 marks
Total			**100 marks**

**SEQ= Structured Essay Question, MTF = Multiple True False, MCQ= Multiple Choice Questions, SBA = Single Best Answer, EMQ = Extended Matching Questions, OSPE=Objective Structured Practical Examination*

- ****The Continuous Assessment marks out of 20, will be considered only for the first attempt at the end of course assessment (3rd MBBS Part 2 Examination). For subsequent attempts the marks out of 80 will be converted to a mark out of 100***

Semester (16 weeks each)	Subject area	
4	General pathology	
	Tumour pathology	
5	Chemical pathology	
	Respiratory pathology	
	Cardiovascular pathology	
6	Haematology	Clinical Pathology Appointment Histopathology/Chemical Pathology/Haematology /Transfusion Medicine
	Gastrointestinal pathology	
	Hepatobiliary pathology	
	Pathology of skin & Reticulo-endothelial system	
7	Bone pathology	
	Breast pathology	
	Endocrine Pathology	
	Pathology of Female genital tract	
	Pathology of Male genital tract	
	Renal pathology	
	Central nervous system pathology	

Figure 01

Teaching and Learning Activities and Hours

Semester IV				
	Lecture hours	Tutorial hours	Practical hours	TLA activities
General Pathology	14	01	1	Lectures Practical Tutorials
Tumour Pathology	09	01		
Total	**23**	**02**	**1**	
Semester V				
Chemical Pathology	11	03	-	Lectures Tutorials
Respiratory Pathology	06	01	01	Lectures Practical Tutorials
Cardiovascular System Pathology	09	01		
Total	**26**	**05**	**01**	
Semester VI				
Gastrointestinal Pathology	07	01	01	Lectures Practical Tutorials
Liver, Biliary and Pancreatic Pathology	06	01		
Skin Pathology	01	-	-	Lectures
Pathology of Reticulo-endothelial System	02	-		
Haematology	20	01	05	Lectures Practical Tutorials
Total	**36**	**03**	**06**	
Semester VII				
Bone Pathology	02	-		Lectures
Breast Pathology	02	01	01	Lectures Practical Tutorials
Endocrine Pathology	02	01	01	Lectures Practical Tutorials
Female Genital Tract Pathology	03	01	01	Lectures Practical Tutorials
Male Genital Tract Pathology	03	-	01	Lectures Tutorials
Renal Pathology	04	01	01	Lectures Practical Tutorials
Central Nervous System Pathology	04	01	01	Lectures Practical Tutorials
Total	**20**	**05**	**06**	

Clinical Pathology Appointment – Hospital Laboratory based - 48 hours (Histopathology/Chemical Pathology/Haematology/Transfusion Medicine)

Description of Teaching/Learning activity	Contact Hours	Independent Student Learning (ISL) Hours	Notional Hours	Calculation of Credit Value	Credit Value
Lectures	106	212	318	320/50	6.4
Tutorials/SGD	17	17	34	35/50	0.7
Practicals	30	15	45	45/50	0.9
Total – Faculty based learning	153	244	397	397/50	8
Hospital Lab based clinical appointment (Clinical Pathology Appointment.)	48	10	58	58/50	1
Total credit value of the Pathology Programme	208	254	455		9Credits

COURSE LEARNING OUTCOMES

1. Describe the basic pathological processes and concepts in terms of pathogenesis and morphological changes in tissues.
2. Describe specimen collection, transport, and proper handling regarding histopathological, cytological investigations, as well as haematological and chemical pathology.
3. Describe the aetiopathogenesis and pathological changes associated with disorders in the cardiorespiratory, gastrointestinal, hepatobiliary, genitourinary, endocrine, locomotion, and central nervous systems
4. Explain the association of morphological changes with basic clinical features.
5. Explain the pathological basis of clinical features of diseases affecting the above systems.
6. Explain the basis of the applications of basic laboratory investigations in the diagnosis and management of diseases in these systems.
7. Explain the basis of blood grouping, compatibility testing, indications, and the principles of managing transfusion reactions.
8. Interpret the results of haematological tests in the context of the overall clinical picture of the patient.
9. Analyze the mechanisms of common disease processes involving blood cells (red cells, white cells, platelets) and the coagulation system.

General objectives

1. To introduce students to the basic pathological processes that underlies all diseases
2. To relate the disease processes to the clinical symptoms and signs
3. To provide sufficient factual details on pathology of common and important diseases
4. affecting specific organs and organ systems. This includes pathogenesis, pathological
5. changes and the natural outcomes of diseases
6. To provide knowledge in how laboratory investigations can establish the true nature of
7. the illness and monitor its progress and response to therapy
8. To integrate basic pathology into the decision-making process for patient care

INTENDED LEARNING OUTCOMES (ILOs) OF EACH SESSION

Histopathology

At the end of each session, students should be able to;

1. **General Pathology**
    - **a.** Cellular Injury, Cell Death and Degeneration
        - i. list the common causes of cell injury
        - ii. give examples of reversible cellular injury and explain the morphologic and ultrastructural changes associated with both
        - iii. define cell death, including the different morphological types (necrosis and apoptosis) and their significance
        - iv. list and describe the different types of necrosis in tissue or organs, including their morphology and aetiology
        - v. identity the types of degenerative changes in tissues and their morphology with examples for each
    - b. Inflammation
        - i. Acute Inflammation
            1. define acute inflammation
            2. explain the sequence of vascular and cellular events in the histologic evolution of acute inflammation

3. identity the roles of various “chemical mediators” of acute inflammation
4. explain the possible patterns of acute inflammation
5. explain the possible outcomes of acute inflammation
6. identify the clinical manifestations of acute inflammation with reference to their underlying pathogenetic mechanisms

ii. Chronic Inflammation

1. define chronic inflammation
2. list the causes of chronic inflammation
3. explain the morphologic patterns, principal cells of chronic inflammation
4. define chronic granulomatous inflammation
5. list examples of diseases with granulomatous inflammation
6. describe the morphology of granulomatous inflammation
7. identity the clinical manifestations of chronic inflammation with reference to their underlying pathogenetic mechanisms
8. explain the possible outcomes of chronic inflammation
9. describe the aetiology, pathogenesis, morphology and complications of chronic inflammation with regard to tuberculosis and syphilis

c. Regeneration and Repair

i. classify cells (with examples) based on their regenerative activity
ii. define and contrast regeneration and repair
iii. explain the processes of wound healing by primary and secondary intension with examples
iv. outline the basic steps in fracture healing list and discuss the factors (local and systemic) that influence the rate of wound healing

d. Pathological Calcification

i. define pathological calcification
ii. briefly describe the mechanism of calcification
iii. identify the two main types of pathological calcification with examples in relation to aetiology, pathogenesis, morphology and clinical effects

e. Pathological Pigmentation

i. identify exogenous and endogenous pigments in the body

ii. explain the distribution, morphology and clinical significance of exogenous and endogenous pigments in the body

f. Circulatory Disturbances

i. Oedema, Congestion and Hyperemia

1. define oedema and its pathological basis
2. explain the range of clinical effects of oedema
3. compare and contrast hyperaemia and congestion
4. identify the causes of acute and chronic congestion of lungs, liver and describe the morphological changes

ii. Shock

1. define shock
2. explain different types and causes of shock and highlight the pathogenesis of shock in each type
3. identify the stage of shock and explain the pathophysiological changes and clinical features at each stage
4. describe the morphological changes produced by shock in relation to different organs
5. explain the pathological basis of shock in a given clinical scenario

iii. Thrombosis

1. define thrombosis, distinguish it from clotting list the main factors (Virchow triad) that predispose to thrombosis
2. compare and contrast venous and arterial thrombosis in relation to the predisposing factors, morphology and clinical effects
3. explain the fate of a thrombus

iv. Embolism

1. define embolism
2. classify embolism
3. describe each type of embolism in relation to the causes, pathogenesis and clinical effects

v. Infarction
    1. define infarction
    2. distinguish arterial and venous infarcts and list common sites
    3. identify the main causes of infarction in a given clinical situation
    4. explain the difference between the pathogenesis of red and pale infarcts
    5. analyze clinical effects of commonly occurring ischemic events due to thrombosis and embolism to identify mechanisms, pathogenesis, relevant investigations and predict usual outcomes

vi. Amyloid
    1. describe the properties of amyloid
    2. describe the types of amyloid
    3. using clinical examples, compare and contrast systemic and localized amyloidosis
    4. describe the macroscopic and microscopic findings of amyloidosis and correlate it to the possible clinical implications

vii. Disorders of growth
    1. identify major adaptive reactions in tissues to persistent stress
    2. define hypertrophy, hyperplasia, atrophy, metaplasia and dysplasia
    3. compare and contrast the different types of disorders of growth
    4. describe the aetiology, morphology and clinical effects of major adaptive reactions with examples

g. Tumour Pathology
    i. define the term neoplasia describe the different classifications of tumour
    ii. describe the nomenclature of tumours according to the tissue of origin
    iii. describe macroscopic and microscopic features of benign tumours
    iv. describe macroscopic and microscopic features of malignant tumours
    v. describe the cytological features of malignancy
    vi. describe the mechanism of carcinogenesis
    vii. list carcinogenic agents

viii. list the known chemical carcinogens and their associated tumours
ix. define initiators and promoters in carcinogenesis
x. list oncogenic viruses and their associated tumours
xi. briefly describe the carcinogenic effect of radiation with examples
xii. describe routes of tumour spread and mechanism of tumour metastasis
xiii. describe the effects of benign and malignant tumours
xiv. define para-neoplastic syndrome
xv. list tumors associated with para-neoplastic syndrome
xvi. describe the term pre-invasive malignancy list pre-invasive malignancies
xvii. list prognostic markers of malignancies l
xviii. ist the investigations done to diagnose a tumour
xix. describe the important aspects in transport of specimens for cytology and histological assessment
xx. list tumour markers and their associated tumours
xxi. describe the
    1. common sites
    2. macroscopic appearance
    3. microscopic appearance
    4. relevant tumour markers-if available, of common tumours

2. Systemic Pathology

a. Cardiovascular System
    i. Arterial Diseases-Atherosclerosis/Aneurysm/Vasculitis
        1. list the type of arteriosclerosis
        2. describe the aetiology and pathogenesis of atherosclerosis
        3. describe the morphological changes in atherosclerosis including complications
        4. explain the clinical effects of atherosclerosis in small and large arteries
        5. describe the pathogenesis and clinical effects of arteriolosclerosis
        6. briefly describe Monckeberg's arteriosclerosis
        7. define aneurysm
        8. describe pathogenesis, morphology and clinical effects of aneurysm
        9. list types of vasculitis and their clinical effects

ii. Ischaemic heart disease
    1. list the risk factors of ischaemic heart disease
    2. describe the syndromes of myocardial ischaemia
    3. explain the pathological basis of different types of myocardial ischaemia
    4. describe the morphology of acute and chronic ischaemic heart disease
    5. describe the complications of ischaemic heart disease
    6. list the causes of sudden cardiac death

iii. Cardiomyopathy and myocarditis
    1. classify cardiomyopathy
    2. describe causes and the morphology of cardiomyopathy
    3. explain the pathological basis of clinical effects of cardiomyopathy
    4. list the aetiological agents of myocarditis
    5. describe the morphology of myocarditis
    6. describe the clinical effects of myocarditis

iv. Rheumatic heart disease
    1. describe the aetiology and pathogenesis of rheumatic heart disease
    2. describe the morphology of acute and chronic rheumatic heart disease
    3. explain the pathological basis of clinical effects of rheumatic heart disease, including complications

v. Infective endocarditis
    1. describe a vegetation
    2. list conditions in which vegetations can be seen in the heart
    3. identify the features of infective endocarditis
    4. classify infective endocarditis
    5. compare and contrast the pathogenesis of acute and sub-acute infective endocarditis
    6. explain the pathological basis of clinical manifestations of infective endocarditis
    7. describe the pathological changes of different types of infective endocarditis
    8. describe the complications of infective endocarditis

9. compare and contrast nonbacterial thrombotic endocarditis, endocarditis of Systemic Lupus Erythematosus (SLE) and infective endocarditis

vi. Heart failure

1. describe the aetiology and pathogenesis of heart failure
2. define cor-pulmonale
3. explain the pathological basis of clinical features of heart failure

b. Respiratory Pathology

i. Acute pneumonia

1. define pneumonia
2. classify pneumonia
3. describe the pathogenesis
4. describe the morphological changes in pneumonia
5. correlate the pathological changes with the clinical features
6. explain the pathological basis of complications of pneumonia

ii. Tuberculosis

1. describe the factors predisposing to pulmonary tuberculosis
2. describe the pathogenesis of pulmonary tuberculosis
3. describe the progression of pulmonary tuberculosis
4. describe the morphological changes in pulmonary tuberculosis
5. explain the pathological basis of the clinical effects of pulmonary tuberculosis
6. describe the morphology and clinical effects of extra pulmonary tuberculosis

iii. Chronic obstructive pulmonary disease (COPD)

1. list the entities considered under COPD
2. describe the pathogenesis of COPD
3. describe the morphology of COPD
4. explain the pathological basis of clinical effects of COPD including complications

iv. Chronic diffuse intestinal lung diseases

1. list the entities considered under Chronic diffuse intestinal lung diseases

2. describe the pathogenesis of Chronic diffuse intestinal lung diseases
3. describe the morphology of Chronic diffuse intestinal lung diseases
4. explain the pathological basis of clinical effects of including complications Chronic diffuse intestinal lung diseases

v. Tumour of respiratory system

1. classify lung tumours
2. describe the aetiology and pathogenesis of lung tumours
3. describe the morphology of lung carcinoma
4. explain the pathological basis of clinical effects of primary lung and pleural tumours
5. describe paraneoplastic syndrome related to lung carcinoma
6. describe metastatic lung tumours
7. explain the value of pathological investigation in the diagnosis of lung tumours

vi. Other lung diseases

1. describe the aetiology, pathogenesis and morphology of
    a. ARDS (Acute respiratory distress syndrome)
    b. Pulmonary thromboembolism
    c. Pulmonary infarction
    d. Pulmonary congestion and oedema
    e. Pleural effusion
2. explain the pathological basis of clinical effects of the above lung diseases

c. Gastro intestinal tract Pathology

i. Oesophagus

1. list the congenital abnormalities of oesophagus
2. list the lesions associated with motor dysfunction
3. list the causes of oesophagitis
4. describe the pathogenesis of oesophagitis
5. describe the morphology of Barrett's oesophagus
6. list of the complications of Barrett's oesophagus
7. describe the clinical presentation of oesophageal tumours

8. list the factors associated with development of squamous cell carcinoma of oesophagus
9. describe the morphology of squamous cells carcinoma of oesophagus

ii. Stomach

1. list the causes of gastritis
2. classify gastritis
3. briefly describe each type of gastritis
4. describe the morphological features of acute gastritis
5. describe the morphological features of chronic gastritis
6. list causes of peptic ulcer
7. list the complications of chronic peptic ulceration
8. describe briefly the aetiology and pathogenesis of chronic peptic ulcer
9. list the pre-malignant lesions of the stomach
10. list the tumours of stomach
11. list the clinical features of gastric carcinoma
12. describe the morphological features of gastric carcinoma
13. describe the spread of gastric carcinoma

iii. Intestine

1. list the infective diseases affecting the intestine
2. briefly describe the pathogenesis of typhoid fever
3. briefly describe the morphological features of the intestine in typhoid fever
4. list the complications of typhoid fever
5. describe primary and secondary intestinal TB with morphological features

iv. Appendicitis and mal-absorption syndromes

1. describe the macroscopic appearance of the appendix in appendicitis
2. describe the microscopic features of appendicitis
3. list the complication of appendicitis
4. list the malabsorption syndromes

5. describe the important malabsorption syndromes in relation to aetiology, pathogenesis, morphology and clinical features including complications

v. Inflammatory bowel disease
    1. describe ulcerative colitis and Crohn's disease in relation to aetiology, pathogenesis, morphology and clinical features including complications
    2. compare and contrast ulcerative colitis and Crohn's disease

vi. Intestinal tumours
    1. list the tumour of small and large intestine 8.6.6.2 list the types of intestinal polyps 8.6.6.3 describe briefly the macroscopic appearance of each type of polyps with emphasis on adenomatous polyps 8.6.6.4 list the polyposis syndromes and briefly describe adenomatous polyposis coli 8.6.6.5 list the pre-malignant lesions in the colon 8.6.6.6 describe colorectal carcinoma in relation to in relation to aetiology, pathogenesis, morphology and clinical features including complications 8.6.6.7 describe the spread and prognosis of colorectal carcinoma 8.6.6.8 describe the Duke's staging for colorectal carcinoma 8.6.6.9 list the types of tumours of the anal canal

d. Liver pathology

i. Cirrhosis & portal hypertension
    1. define cirrhosis
    2. list the causes of cirrhosis
    3. briefly describe the aetiology, pathogenesis, clinical features including complications of cirrhosis
    4. describe macroscopic and microscopic appearances of liver in cirrhosis
    5. list the aetiology, pathogenesis, clinical features including complete of portal hypertension

ii. Hepatitis and liver abscess
    1. list the viruses that can cause inflammation of the liver
    2. describe the pathogenesis in relation to aeitiology, pathogenesis, morphology and clinical features including complications
    3. list the clinicopathological syndromes develop in viral hepatitis

4. list the causes of liver abscess
5. briefly describe the macroscopic appearance of liver abscess

iii. Toxin induced liver diseases

1. list the types of hepatotoxins
2. describe alcoholic liver disease in relation to, pathogenesis, morphology and clinical features including complications
3. briefly describe other toxin induced liver diseases including hemochromatosis, Wilsons diseases and drug induced liver injury

iv. Liver tumours & cholelithiasis

1. list the common tumours seen in the liver
2. briefly describe the aetiology, pathogenesis, morphology of hepatocellular carcinoma
3. briefly describe metastatic tumours of the liver
4. briefly describe the pathogenesis clinical features and complications of cholelithiasis

e. Renal Pathology

i. Glomerular disease – An introduction and overview

1. list the different clinical syndromes of renal diseases
2. describe the characteristic clinical features of each syndrome
3. classify Glomerular diseases
4. describe the aetiology and pathogenesis of glomerular diseases
5. describe the common morphological features of glomerulonephritis
6. explain the pathological basis for the clinical features observed in glomerular diseases

ii. Primary glomerular diseases

1. list the common histological types of primary glomerulonephritis which cause Nephrotic syndrome and Nephritic syndrome
2. describe the pathogenesis morphology and laboratory findings in the following primary Glomerular diseases
    a. Acute diffuse proliferative GN
    b. Crescentic GN
    c. Minimal change disease

d. Membranous GN
e. Membrano-proliferative GN
f. Focal segmental glomeruli-sclerosis

iii. Secondary glomerular diseases and the vascular diseases of the kidney
    1. briefly describe the pathology and the laboratory findings in the following Glomerular diseases
        a. Systemic lupus erythematosus
        b. Infective endocarditis
        c. Good pasture syndrome
        d. Diabetic mellitus
        e. Amyloidosis
    2. briefly describe the pathological features observed in the kidneys in essential and malignant hypertension

iv. Diseases affecting tubules and the interstitium
    1. classify tubulo-interstitial nephritis
    2. describe pyelonephritis in relation to aetiology, pathogenesis, morphology and clinical features including complications
    3. briefly describe Interstitial nephritis and Acute tubular necrosis
    4. list the causes of urolithiasis
    5. classify calculi according to chemical composition
    6. explain the morphology, clinical features including complication of urolithiasis
    7. list causes of obstructive uropathy
    8. briefly describe morphology, clinical features and complication of obstructive uropathy

v. Neoplasms of the kidney
    1. classify the benign and malignant neoplasms of the kidney, renal pelvis and the bladder
    2. describe the aetiopathogenesis, Clinical features and morphology of the following neoplasms
        a. Renal cell carcinoma
        b. Nephroblastoma

c. Urothelial carcinoma

f. Female genital tract Pathology
   i. understand the basis of Cervical Intraepithelial Neoplasia (CIN)
   ii. discuss the aetiology, pathogenesis, morphology and clinical features including complications of cervical carcinoma
   iii. discuss the aetiology and clinicopathological features of pathological conditions of endometrium, including endometritis, endometrial hyperplasia & endometrial carcinoma
   iv. describe the clinicopathological features, macroscopy, and microscopy of leiomyoma of uterus
   v. understand ovarian tumours including classification and clinicopathological features
   vi. describe macroscopy and microscopy of special types of ovarian tumours. E.g., Teratoma
   vii. describe the clinicopathological features, macroscopy and microscopy of gestational trophoblastic diseases with special emphasis on hydatidiform mole

g. Breast Pathology
   i. discuss the aetiology and clinicopathologic features of different forms of benign non neoplastic and neoplastic breast diseases with special emphasize to conditions which mimic malignancy
   ii. identify benign breast diseases that increase patients' risk of developing breast cancer
   iii. classify malignant tumours of breast
   iv. describe the concept of in situ carcinoma in breast and the clinical significance
   v. identify the prognostic/predictive factors of breast cancer

h. Male genital tract Pathology
   i. briefly describe outline of inflammatory lesions of testis & epididymis
   ii. briefly describe classification, clinicopathological features, macroscopy and microscopy of testicular tumours with special emphasizes to seminoma
   iii. discuss clinicopathology, macroscopy and microscopy of Benign prostatic hyperplasia and Prostatic carcinoma
   iv. briefly describe the pre-malignant lesions of penis

v. describe aetiopathogenesis and morphology of carcinoma penis

i. Reticuloendothelial System Pathology

i. Pathology of lymph node enlargement and splenomegaly

1. list the causes for lymphadenopathy
2. briefly describe morphology of specific infections of lymph nodes with special reference to tuberculous lymphadenitis
3. list the causes for splenomegaly
4. briefly describe of splenic infarctions

ii. Lymphoma

1. explain the clinical features of lymphoma
2. briefly describe the classification of lymphoma
3. discuss the difference between Hodgkin and Non-Hodgkin lymphoma
4. describe the morphological patterns of specific lymphomas (Hodgkin lymphoma, follicular lymphoma, lymphomas with diffuse pattern)
5. list the methods used in diagnosis of lymphoma

j. Bone Pathology

i. briefly describe the following non-neoplastic disorders, in terms of aetiology, pathogenesis, morphology, and clinical findings; osteoporosis, osteomalacia, hyperparathyroidism, Paget disease, renal osteodystrophy

ii. describe infections of bone and joints (acute/ chronic osteomyelitis and tuberculosis) including pathogenesis, morphology and complications

iii. classify tumours of bone

iv. describe the clinicopathological features of common bone and cartilage tumours (Chondroma chondrosarcoma, osteosarcoma, giant cell tumour of bone)

k. Central Nervous System Pathology

i. Cerebral oedema & increased intracranial pressure

1. briefly describe the pathogenesis of cerebral oedema
2. briefly describe the macroscopic appearance of cerebral oedema
3. list causes of raised intracranial pressure
4. describe in relation to aetiology, pathogenesis, morphology and clinical features including complications of brain herniation

5. list causes of hydrocephalus

ii. Traumatic injuries of brain
    1. briefly describe parenchymal injuries of brain (concussion, direct parenchymal injury and diffuse axonal Injury)
    2. briefly describe in relation to aetiology, pathogenesis, morphology and clinical features including complications of traumatic vascular injury (epidural and subdural haematoma)

iii. Intra cranial haemorrhages
    1. list causes of spontaneous intracerebral haemorrhages
    2. briefly describe in relation to aetiology, pathogenesis, morphology and clinical features including of hypertensive cerebrovascular disease
    3. briefly describe in relation to aetiology, pathogenesis, morphology and clinical features including complications of subarachnoid haemorrhage

iv. Cerebral Hypoxia, ischemia and infarction
    1. briefly describe the pathophysiology of hypoxia, ischaemia and infarction of brain
    2. list the causes of cerebral infarcts
    3. briefly describe the morphology and clinical effects of cerebral infarction

v. Infections
    1. list the causative organisms in meningitis
    2. describe the pathogenesis, morphology, clinical effects and complications of meningitis
    3. list the causes of viral meningo encephalitis
    4. describe predisposing factors of cerebral abscess
    5. describe the CSF changes in viral, bacterial and tuberculous meningitis

vi. CNS Tumours
    1. classify brain tumours
    2. list the brain tumours seen in childhood
    3. list the brain tumours seen in adult
    4. describe clinicopathological effects of intracranial tumours
    5. briefly describe the morphology of common brain tumours

3. Chemical Pathology

i. Introduction to Chemical Pathology

1. describe the scope & clinical significance of tests in Chemical Pathology
2. describe the total testing process and the role of the requesting doctor in the pre analytical and the post-analytical phases
3. describe the principles of sample collection and transport requirements for common general biochemical and specialized biochemical investigations
4. be able to interpret common biochemical test reports

ii. Water & electrolytes

1. assess the level of hydration & volume status of patients
2. explain the pathological basis and consequences of water depletion and excess
3. explain the pathological basis of common electrolyte disturbances in patients
4. plan and interpret basic investigations in electrolyte disturbances to arrive at a definitive diagnosis

iii. Acid base balance

1. explain the mechanisms of acid production in the body
2. explain the mechanisms of regulating blood pH
3. explain the pathological basis and biochemical findings in simple acid base disorders
4. collect samples for arterial blood gas analysis & interpret results
5. request other biochemical investigations and interpret their results to identify the aetiology in a given acid base disorder

iv. Diabetes mellitus

1. list the different types of diabetes mellitus and describe the aetiopathogenesis in each type
2. select appropriate diagnostic tests based on the clinical context and interpret results

3. request relevant biochemical tests for management of glycaemic control & other long-term complications
4. detect acute metabolic complications of diabetes mellitus and request baseline laboratory tests for their management
5. describe the principles of screening for type 2 diabetes & gestational diabetes mellitus

v. Disorders of lipid metabolism
   1. describe the basic structure and metabolism of lipoproteins in plasma
   2. explain the pathological basis of common dyslipidemias, both primary and secondary
   3. discuss the clinical significance of alterations in lipids and lipoproteins in plasma
   4. request basic investigations and interpret results in common lipid disorders

vi. Plasma proteins & enzymes
   1. discuss the clinical significance of measuring total plasma protein and different fractions
   2. define the acute phase response and discuss the clinical significance of acute phase proteins
   3. list the common enzymes used in clinical diagnostics and explain the pathological basis of their alterations
   4. describe sample collection requirements for proteins & enzymes

vii. Investigations for liver disorders
   1. discuss the use of laboratory investigations in assessing patients with acute and chronic liver diseases
   2. outline a plan of investigations for patients with jaundice including neonates with jaundice
   3. explain the pathological basis of biochemical alterations observed in acute and chronic hepatitis caused by different aetiological agents
   4. describe the biochemical alterations observed in common metabolic diseases affecting the liver
   5. describe the biochemical features of liver failure

viii. Investigations for renal disorders

1. list and classify laboratory investigations available to investigate renal diseases
2. describe indications, patient preparation and sample collection and transport for those investigations
3. interpret reports and discuss the limitations of those investigations
4. explain the pathological basis of the investigation findings

ix. Disorders of calcium & phosphate metabolism

1. describe the regulation of serum calcium and phosphate levels
2. list the common diseases leading to hypo & hypercalcaemia & hypo & hyperphosphataemia
3. outline a plan for investigating the above disorders
4. explain the alterations of serum calcium & phosphate observed in metabolic bone diseases

x. Endocrine disorders of the pituitary, thyroid and adrenal glands

1. explain the pathological basis of endocrine dysfunction
2. discuss the principles of laboratory investigations
3. select and request primary and secondary investigations for the common endocrine diseases of the pituitary, thyroid and adrenal glands
4. interpret results of the investigations for patients with common endocrine diseases.

4. Haematology

Aim

Acquisition of knowledge and skills in haematology relevant to perform Professorial appointments in Final year and to practice as an intern house officer and medical officer thereafter Pre requisites:

The students should have a basic knowledge on

- blood cell production, morphology, functions, feedback mechanisms, metabolism and catabolism of blood cells,
- cellular components and constituents of blood,

- basic tests and principles,
- compensatory (physiological) changes in blood cells/ components in relation to physiological needs/changes and
- blood group antigens and antibodies.

Key outcomes

1. At the end of haematology teaching learning program, students should have the knowledge on

a. aetio-pathological basis of manifestations of disorders of blood cell production, morphology, functions, feedback mechanisms, metabolism and catabolism of blood cells, cellular components and constituents of blood, blood transfusions and blood group systems

b. and laboratory investigations including sample collections, data interpretation and performance of common haematological tests

2. At the end of successful completion of curriculum, students should be able to answer questions in theory, practical and viva voce examinations to get through the Pathology component of the 3rd MBBS Part II examination

3. Following themes/topics/ content areas are included in Haematology component of Pathology curriculum to achieve above objectives/goals.

4. Relevant theory and practical components shall be taught and learned by following lectures, practical and clinical pathology appointment which are included in formal teaching schedules.

i. Haemopoiesis
    1. list factors necessary for haemopoiesis,
    2. Describe sites of blood cell production and physiological basis
    3. Define and discuss features of intramedullary haemopoiesis and extramedullary haemopoiesis and clinical relevance
    4. Describe effective and ineffective erythropoiesis and its applications in disease pathogenesis

5. discuss changes in haemopoiesis from intra-uterine to extra-uterine life including gene switching & changes in Hb subtypes
6. Discuss physiological basis for neonatal jaundice
7. List tests in evaluation of haemopoiesis
8. Critically analyze manifestations and test results in relation to haemopoiesis and components required for haemopoiesis which lead to disease

ii. Anaemia-Definition, classification, general manifestations and basic investigations, terminology and interpretation of basic investigations in anaemia

1. define anaemia and describe rationale of the definition by giving examples and application of definition in clinical practice
2. Classify anaemia, compare and contrast different types and state clinical examples for each category of anaemia
3. Describe basic clinical manifestations in different types of anaemia and its pathological basis
4. List tests useful to assess haemopoiesis, samples to be collected and expected results (interpretation of results) as per different categories of anaemia and pathological basis for the expected findings
5. describe usefulness and interpretation of automated full blood count, blood picture and retic count based on different types of anaemia and pathological basis for the findings
6. To apply correct terminology of red cell morphology when describe different haematological disorders
7. able to interpret FBC report and blood picture to arrive at a diagnosis or differential diagnosis
8. extrapolate manifestations to anaemic disease

iii. Aplastic anaemia (AA)

1. define AA and application of definition in the diagnosis
2. describe presentation, epidemiology, different aetiological factors
3. describe pathological basis of AA anaemia and clinical features

4. discuss investigations, expected findings and pathological basis for the findings
5. describe basics in management of a patient with AA

iv. Anaemia of chronic disease/chronic inflammation (ACD)/ and chronic kidney disease(CKD)

1. define ACD/CKD
2. list causes and describe pathological basis for anaemia in ACD and CKD
3. describe expected findings in basic laboratory tests and serum iron studies in ACD and CKD
4. describe basics in management of anaemia in ACD and CKD

v. Nutritional deficiencies. Iron deficiency, vitamin B 12 and folate deficiency

1. describe different causes and pathogenesis of anaemias due to iron deficiency, vitamin B 12 deficiency and folate deficiency and explain the pathological basis for the different clinical manifestations
2. suggest investigations should be performed to diagnose iron deficiency, vitamin B 12 & folate deficiency and interpret and describe expected findings
3. outline basic management and monitoring of therapy
4. Discuss basis/causes for refractoriness for therapy

vi. Haemolytic anaemia

1. define and classify haemolytic anaemia
2. compare and contrast manifestations of different types of haemolytic anaemia
3. list investigations, expected findings and interpretation of results and extrapolate manifestations to haemolytic anaemias

vii. Haemoglobinopathies as defects of haemoglobin

1. define thalassaemia and describe pathological basis for the manifestations in thalassaemia

2. list investigations, expected findings and interpretation of results
3. compare and contrast different types of thalassaemia
4. describe potential outcomes of thalassaemia trait marriage
5. describe management and important aspects in management of thalasaemia major
6. describe presentation and pathogenesis of sickle cell disease
7. list investigations, expected findings and interpretation of results

viii. hereditary spherocytosis (HS) and G6PD deficiency as defects of red cell membrane and enzymes respectively

1. define and describe presentation, clinical significance and pathological basis for manifestations
2. describe confirmatory tests, interpretation and sampling requirements for the confirmatory test
3. list causes for spherocytes in blood
4. list complications
5. outline important aspects in management of these conditions

ix. Acquired haemolytic anaemia

1. classify different types of acquired haemolytic anaemia
2. describe pathological basis for autoimmune haemolytic anaemia, alloimmune haemolytic anaemia including haemolytic disease of newborn and transfusion reaction
3. discuss and describe investigations in autoimmune haemolytic anaemia and alloimmune haemolytic anaemia
4. list red cell fragmentation syndromes, their clinical significance and expected findings in blood picture

x. Disorders of Myeloid Stem Cells

1. outline properties of stem cells and explain pathological basis for myeloproliferative disorders, myelodysplasia and myeloid leukemia

2. classify myeloproliferative neoplasia and describe pathogenesis, clinical manifestations, investigations and basic management of
    a. Chronic myeloid leukemia
    b. polycythemia vera
    c. Essential thrombocythemia
    d. Myelofibrosis
3. List causes for leukaemoid reaction, leukoerythroblastic blood picture, polycythemia, thrombocytosis
4. list causes for marrow fibrosis
5. define myelodysplastic syndrome and identify it as a cause of Bone marrow failure

xi. Acute leukemia (Acute myeloid leukaemia and Acute lymphoblastic Leukaemia)
    1. define acute leukaemia
    2. outline the basic classification.
    3. outline the pathogenesis.
    4. initiate baseline investigations & arrive at a diagnosis.
    5. outline the steps of management.
    6. learn the key features of acute leukaemia and the importance of early diagnosis

xii. Chronic leukaemia
    1. Chronic Myeloid leukaemia-ref XV.a.
    2. Chronic lymphocytic leukaemia
        a. outline clinical presentation, laboratory diagnosis and treatment options.

xiii. Multiple Myeloma and plasma cell dyscrasia
    1. list the causes of Paraproteinaemia
    2. list the other plasma cell neoplasms
    3. define Multiple myeloma
    4. discuss the Pathogenesis, diagnosis & principles of treatment of Multiple myeloma including diagnostic criteria, clinical features and

complications explained by pathology, laboratory findings, prognosis and treatment

xiv. Haemostasis Introduction

1. describe basic phases in haemostasis and its components
2. describe clinical manifestations in haemostasis failure
3. outline preliminary work up of a patient with haemostasis failures
4. describe sample requirements for coagulation testing

xv. Defects in Primary Haemostasis

1. outline classification of defects in primary haemostasis failure giving examples for each sub type
2. discuss aetiopathogenesis of immune thrombocytopenia (ITP), its manifestations, investigations and expected findings
3. outline principles of management
4. discuss aetiopathogenesis of von Willebrand disease, its manifestations and investigation of suspected vWD patient
5. outline principles of management
6. discuss causes for thrombocytopenia and platelet dysfunction

xvi. Defects in Secondary Haemostasis

1. outline classification of defects in secondary haemostasis failure giving examples for each sub type
2. discuss aetiopathogenesis of Haemophilia
3. outline management and monitoring of treatment
4. critically discuss chronic liver parenchymal disease as an important acquired cause for haemostasis failure and its underlying pathology
5. outline briefly thrombophilia and thrombophilic disorders
6. discuss aetiopathogenesis of disseminated intravascular coagulation (DIC), manifestations and diagnosis

xvii. Blood transfusion, complications and investigations

1. discuss appropriate preparation, storage and uses of blood and blood products 8.16.16.2 discuss ABO and Rh blood group systems, grouping, cross matching, clinical implications thereof
2. classify complications related to transfusions of blood and blood derived products
3. describe manifestations, causes and pathological basis of acute haemolytic transfusion reaction (HTR)
4. outline transfusion reactions other than HTR
5. discuss aetiopathogenesis of haemolytic disease of newborn its manifestations and principles of management

xviii. Haemopoietic Stem Cell Transplant

1. describe properties of stem cells
2. discuss briefly different types/ sources of stem cells for transplantation and Limitations
3. outline indications and basic investigations required when prepare a patient for SCT
4. basics in managing a patient following SCT

- **Recommended books for reading;**

Recommended Books

- Muir's Textbook of Pathology C Simon Herrington. CRC Press.
- Basic Pathology, Cotron R, Kumar V, Robbins SL, Saunders. Philadelphia.
- General and Systematic Pathology, J.C.E. Underwood, Simon Cross. Churchill Livingston.
- Essential Hematology, Hoffbrand AV, Pettit JE & Moss PAH Blackwell Publishing. Oxford.
- Clinical Chemistry, Marshall WJ, Bangert SK, Mosby. Missouri.

Supplementary Reading (Optional)

- Hematology for the medical student, Schmaier AH, Petruzzelli LM Lippincott Williams & Wilkins. Philadelphia
- Kumar and Clerk's Clinical Medicine, Feather A, Randall D,Waterhouse M. Elsevier
- Davidson's Principles and Practice of Medicine, Ralston S, Penman I, Strachan M, Hobson R. Elsevier

Annexure 01

Objectives for Students

Clinical Pathology – Appointment

<table>
<tr><th colspan="2">Haematology</th></tr>
<tr><td rowspan="13">1. Tests to be observed

Objectives
• List the tests and list the; Indications, Principles, Limitations and Interpretation of each

• Explain the principles of sample collection, identify the pre-analytical and post analytical errors and describe how to prevent pre-analytical errors</td><td>FBC by analyzer & concept of flagging results
Blood picture slide preparation, staining & reporting</td></tr>
<tr><td>Reticulocyte preparation</td></tr>
<tr><td>ESR by Westergren method</td></tr>
<tr><td>HCT estimation</td></tr>
<tr><td>Urine for Haemosiderin</td></tr>
<tr><td>D dimer</td></tr>
<tr><td>Brewer’s test</td></tr>
<tr><td>HAM test</td></tr>
<tr><td>Cryohaemolysis test</td></tr>
<tr><td>Osmotic fragility test</td></tr>
<tr><td>HPLC</td></tr>
<tr><td>Coagulation Tests
• Prothrombin time
• Activated Partial thromboplastin time
• Thrombin time
Special tests- DRVVT/ Clotting factor assays (Factor VIII/ VWF)</td></tr>
<tr><td>Special stains
• Iron stain
• Sudan Black
• PAS</td></tr>
<tr><td>2. Procedures to be observed
Objectives
• To know the Indications, Patient preparation, procedural steps, sample collection, possible complications

• How to educate/ how to assess compliance / how to deal with sub-therapeutic and supra-therapeutic INR values in patients on warfarin therapy.</td><td>• Bone marrow aspiration and Biopsy

• Phlebotomy procedure /Proper completion of request forms

• Monitoring of Anticoagulation as an OPD procedure</td></tr>
<tr><td colspan="2">Transfusion Medicine</td></tr>
</table>

<table>
<tr><td>1. Tests to be performed

Objectives

• Explain the basis of blood grouping, compatibility testing, indications & adverse effects of blood components and blood products</td><td>• Blood grouping and Cross matching</td></tr>
<tr><td></td><td></td></tr>
<tr><td>2. Procedures to be observed
Objectives
• Describe how the components are prepared and stored in blood bank</td><td>• Blood component preparation and storage</td></tr>
<tr><td>Objectives
• To observe how to fill properly and purpose of each of these blood bank documents.</td><td>• Red cell request form
• Component request form
• Reporting of adverse reactions of blood /product transfusion</td></tr>
<tr><td colspan="2">Histopathology</td></tr>
<tr><td colspan="2">1. To be observed

Objectives
• Identify different types of biopsies received in a histopathology lab
• Observe surgical specimen transport
• Be able to complete a request form
• Identify fixatives: Name, quantity & type of the containers.
• Observe specimen reception procedure
• Describe macroscopic features of the specimens received.
Observe processing and preparation of a microscopy slide.
• List few special stains and their indications : Ex: Congo red/ Reticulin
• Observe different types of cytology specimens received in a histopathology lab and the fixatives used.</td></tr>
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- Observe fine needle aspiration cytology procedure and to know the items required to perform FNAC.

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<tr><td colspan="2">Chemical pathology</td></tr>
<tr><td>

2. <u>To be observed</u>

- Observe different types of samples received at the chemical pathology lab.
- Identify different containers used for sample collection and quantity of blood needed, specimen transport and any special steps taken, patient preparation for different tests-
- Interpret the significance of test results with clinical correlation
* Prepare at least 5 case scenarios with 5 different abnormal test results.
- How to deal with flagged values in test results.

</td><td>

- FBS/PPBS/HbA1c
- Lipid profile /Thyroid profile/ Renal profile
- Serum Iron studies
- Serum ionized Calcium/ Sodium, Pottassium/chloride/Magnesium
- Serum LDH
- Serum protein electrophoresis and immune fixation
- Cardiac Enzymes
- Hormone profiles- Serum Cortisol, Renin, Aldosterone, Short synacthen test, Growth hormone

</td></tr>
<tr><td colspan="2">Microbiology</td></tr>
<tr><td>

<u>To be observed</u>

- Procedure of receipt of specimens for microbiology at the counter and verification of identity of each specimen with the request form.
- Bench practices of preparation of stained and unstained specimens for direct microscopy.

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- Specimen reception
- Bacterial / Fungal culture procedures
- ABST technique

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</table>

• Procedures of culture of specimens for isolation of bacteria and fungi. • ABST techniques **<u>To be performed</u>** • Gram and acid fast stains of specimens and cultures for observation of cells, morphology, Gram character and possible identification of the organism. • Identify microscopic features of bacteria, yeasts, pus cells, epithelial cells ,clue cells in stained slides. • Identify fungal filaments, spores and yeasts in KOH mounts of skin, hair & nail specimens. • Interpret culture and ABST reports of specimens	• Gram stain • Acid fast stain • Identification under microscope • Interpret ABST's to determine susceptibility or resistance of bacteria to antibiotics

Supervisor's Assessment

Procedure	Number observed/ performed	Supervisor's signature

Supervisor's Assessment

Procedure	Number observed/ performed	Supervisor's signature

End of Appointment presentation

Date	Topic	Supervisor's Remarks	Supervisor's Signature