

Blood & Immunology Module I
First Professional Year MBBS
5 Weeks



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General Learning Outcomes

COGNITIVE DOMAIN

By the end of this module, First year MBBS students shall be able:

1. Identify & describe the various cellular and non-cellular components of blood in relation to its Anatomy, Physiology & Biochemistry
2. Describe structure, synthesis and degradation of Hemoglobin
3. Describe the regulatory mechanisms of normal hemostasis and coagulation
4. Describe the conditions associated with dysfunction of cellular and non-cellular components of blood
5. Describe the basic characteristics of immune system.
6. Discuss the structure, functions and biochemical aspects of the Lymphoreticular system.
7. Explain the principles and clinical significance of ABO/RH blood grouping system
8. Explain the pathophysiology of various bleeding disorders
9. Identify the role of pharmacology in anemia and bleeding disorders.

PSYCHOMOTOR DOMAIN

Description of the psychomotor skills to be developed and the level of performance required:

By the end of BLOOD Module, the student should be able to:

1. Carry out practical work as instructed in an organized and safe manner
2. Make and record observations accurately.
3. Identify slide of Lymph node, thymus, tonsils and spleen under microscope
4. Identify slide of Gut associated lymphoid tissue
5. Determine percentage of formed blood elements.
6. Identify RBC and should be able to do its counting on counting chamber and to know normal values. And also classify Anemia morphologically.

7. Determine the Hemoglobin with the apparatus and have knowledge of normal and abnormal value.
8. Identify WBC morphology and its different types, should be able to count them on counting chamber and to know the normal values. Diagnostic importance of each WBC.
9. Identify Platelets and should be able to do its counting on counting chamber and to know normal values. Its diagnostic importance in relation to bleeding disorders
10. Perform bleeding time and clotting time and to know normal values and its diagnostic importance in relation to bleeding disorders.
11. Perform Blood groups typing and Rh factor.
12. Perform ESR and to know its normal value and prognostic importance.
13. Detect blood, bile pigments & bile salts in the given sample of urine

ATTITUDE AND BEHAVIOUR

By the end of BLOOD Module the student shall gain the ability and carry responsibility to:

1. Demonstrate ability to give and receive feedback, respect for self and peers.
2. Demonstrate empathy and care to patients.
3. Develop respect for the individuality and values of others - (including having respect for oneself) patients, colleagues and other health professionals
4. Organize & distribute tasks
5. Exchange opinion & knowledge
6. Develop communication skills and etiquette with sense of responsibility.
7. To equip themselves for teamwork
8. Regularly attend the classes
9. Demonstrate good laboratory practices

THEMES FOR BLOOD MODULE

SNO	Theme	Duration
1	Pallor and swelling	2 weeks
2	Fever (Infection and Immunity)	2 weeks
3	Excessive bleeding & Transfusion Reaction	1 week

THEME -I		
Pallor and Swelling		
SNO	Topic	Learning Outcomes
ANATOMY		
1	Introduction to hematopoietic system	<ol style="list-style-type: none"> 1. Describe various components of hematopoietic system including their locations and their functions 2. Describe surface anatomy and applied anatomy of main organs of hematopoietic system 3. Define and classify lymphoid organs and lymphoid tissues
PHYSIOLOGY		
2	Introduction to Blood	<ol style="list-style-type: none"> 4. Describe the composition and functions of blood 5. Define Hematocrit 6. Enlist the components of plasma 7. Explain the difference between Serum and plasma
3	Red Blood Cells	<ol style="list-style-type: none"> 8. Describe the structure, function, life span and normal count of Red Blood Cells. 9. Define Haemopoiesis 10. Classify haematopoietic stem cells 11. Summarize the erythropoiesis sites during pre-natal and post-natal periods.

4	Red Blood Cells Genesis Erythropoiesis	<p>12. Illustrate the stages of RBC development from pluripotent hematopoietic stem cells to a mature RBC.</p> <p>13. Describe the erythropoiesis and factors regulating erythropoiesis</p> <p>14. Describe the role of Vitamin B12 and Folic acid in RBC maturation.</p> <p>15. Describe the effects of deficiency of Vitamin B12 and Folic acid on RBC maturation.</p>
5	Erythropoitin	<p>16. Describe source, control / regulation and functions of Erythropoitin</p> <p>17. Explain the role of Erythropoietin in RBC production.</p> <p>18. Describe the effects of high altitude and exercise on RBC production.</p>
6	Anemia	<p>19. Define and describe the different types of anemia</p> <p>20. Define hemolysis</p> <p>21. Describe the various red cell indices</p> <p>22. Interpret the diagnosis of anemia by using red cell indices</p> <p>23. Describe the effects of anemia on functions of circulatory system / human body</p>
7	Polycythemia	<p>24. Define and classify polycythemia</p> <p>25. Differentiate between primary and secondary Polycythemia</p>
BIOCHEMISTRY		
8	Introduction of Porphyrins	<p>26. Define Porphyrins</p> <p>27. Describe Chemistry of Porphyrins</p> <p>28. Enlist the types, metabolic causes and clinical</p>

		presentation of different types of Porphyrins.
9	Iron metabolism	29. Describe the iron metabolism
10	Introduction to heme synthesis and degradation	30. Define heme and Describe its structure and functions 31. Describe the biochemical features of the hemoglobin molecules 32. Describe Heme Synthesis on cellular and molecular level 33. Describe Heme Degradation 34. Describe the Regulation of Heme Synthesis. 35. Describe the concept of Oxygen binding with hemoglobin 36. Describe the normal picture of blood chemistry.
11	Hemoglobinopathies	37. Define Hemoglobinopathies and enlist the variants of hemoglobin 38. Describe causes of Hemoglobinopathies 39. Describe two major categories of hemoglobinopathies 40. Describe the amino acid substitution in sickle cell disease. 41. Define and Classify thalassemias. 42. Explain the genetic defects in α and β thalassemias. 43. Enlist the clinical features of α and β thalassemias
12	Water soluble vitamins	44. Discuss water soluble vitamins including Vitamin B complex Vitamin C Folic Acid

PATHOLOGY		
13	<ul style="list-style-type: none"> • Anemia's of diminished erythropoiesis 	45. define anemia 46. List the factors for regulation of erythropoiesis 47. Enlist the types of anemia
14	<ul style="list-style-type: none"> • Hemolytic anemia's 	48. Define hemolytic anemia. 49. Enlist types of hemolytic anemia.
PHARMACOLOGY		
15	Drug treatment of anemia's	50. Enlist the drugs used in the treatment of iron deficiency & Megaloblastic anemia 51. Describe the pharmacological basis/ role of iron in iron deficiency anemia (hypochromic normocytic anemia) 52. Describe the pharmacological basis/ role of vit B12 and folic acid in megaloblastic anemia 53. Describe the role of Erythropoietin in the treatment of Anemia (normochromic normocytic anemia)
COMMUNITY MEDICINE		
16	Epidemiology of blood borne diseases	54. Describe Epidemiology of Iron Deficiency Anemia 55. Describe prevention of different types of anemia's in community

LAB WORK		
ANATOMY PRACTICAL (HISTOLOGY)		
17	Histology	56. Identify and describe the microscopic anatomy of lymph node, thymus, bone marrow and spleen under microscope 57. Compare the histological features of lymph node, thymus and spleen

PHYSIOLOGY PRACTICAL		
18	Hemoglobin determination	58. Assist in phlebotomy while practicing aseptic procedure. 59. Determine the hemoglobin (Hb) concentration in the given sample 60. Estimation of hemoglobin by Sahli's method 61. Determination of packed cell volume
19	Blood cells	62. Identify and describe various blood cells under microscope.
20	RBC count	63. Determine the red blood cell (RBC) count in the given sample and calculate RBC indices

THEME -II

Fever (Infection and Immunology)

SNO.	Topic	Learning Outcomes
ANATOMY		
23	Gross anatomy of hematopoietic system	64. Locate, identify and describe the main gross external features of spleen, lymph node, thymus and tonsils 65. Describe neurovascular supply of the mentioned structures 66. Outline the surface anatomy of main lymph nodes, spleen, thymus and tonsils 67. Enlist the causes of splenic injuries
24	Histology of lymphoid tissues	68. Describe the overview of lymphatic tissue including MALT 69. Identify and describe the histological features and functions of Lymph node 70. Identify and describe the histological features and functions of Thymus 71. Identify the locations of tonsils and describe the histological features and functions of Tonsils 72. Describe the histological features and functions of spleen.
25	Embryology/ Developmental Anatomy of lymphoid tissue	73. Describe the development of lymphoid organs including lymph nodes, tonsils, thymus and spleen
PHYSIOLOGY		
26	White Blood	

	Cells	<p>74. Classify white blood cells</p> <p>75. Describe the structure, function, life span and normal count of White Blood Cells</p> <p>76. Describe the stages of differentiation of white blood cells (leukopoiesis)</p> <p>77. Describe the characteristics of WBCs (phagocytosis / chemotaxis, diapedesis)</p>
27	Reticulo-endothelial (Monocyte-Macrophage) system	<p>78. Describe the components of reticulo-endothelial system (monocyte-macrophage system)</p> <p>79. Describe the role of monocyte macrophage system in immunity</p> <p>80. Explain the role of neutrophils, macrophages, basophils, eosinophils and monocytes in providing immunity against infections (immune system)</p>
28	Inflammation	<p>81. Define inflammation</p> <p>82. Describe characteristics of inflammation (hallmark of inflammation)</p> <p>83. Describe the causes, sequence of events and cardinal signs of inflammation</p>
29	Abnormal leukocyte counts/ Leukemia	<p>84. Define Leukopenia and Leukocytosis and Leukemia</p>
30	Introduction to immunity	<p>85. Define and classify immunity</p> <p>86. Define antigen</p> <p>87. Define pathogen</p> <p>88. Enlist the tissues that contribute to immunity and explain their function</p> <p>89. Describe the functions of immune system</p> <p>90. Describe the structure and function of lymphatic system</p>
31	Immune system	<p>91. Enlist the three lines of defenses and outline their properties</p> <p>92. Describe the characteristics, origin and functions of cells of immune system</p>

		<p>93. Describe the types of immunity</p> <p>94. Enlist the innate defenses</p> <p>95. List the substances and cells that participate in adaptive immunity</p> <p>96. Compare the characteristics innate and acquired immunity</p> <p>97. Compare the active and passive immunity mechanism</p>
32	Immune response	<p>98. Differentiate between primary and secondary immune response</p> <p>99. Describe the roles of cytokines, chemokines, and colony-stimulating factors in the immune response</p>
33	Humoral and cell mediated immunity	<p>100. Describe the role of T and B lymphocytes in immunity</p> <p>101. Describe the role of B lymphocytes in humoral immunity</p> <p>102. Describe cell mediated and humoral immunity</p> <p>103. Explain how helper T cells regulate the immune system</p> <p>104. Explain the function of cytotoxic T cells</p> <p>105. Describe the role of helper T cells</p> <p>106. Differentiate between humoral and cell mediated immunity</p>
34	Complement system	<p>107. Describe the complement system</p> <p>108. Explain how the complement system elicits the inflammatory response, lyses foreign cells, and increases phagocytosis</p> <p>109. Describe the two pathways that activate the complement system</p> <p>110. compare Classic and alternate pathways pathways of complement activation</p>
35	Immunity: extremes of ages	<p>111. Compare the active and passive immunity</p>

		<p>112. Explain the transfer of passive immunity from mother to fetus and from mother to infant during breast-feeding</p> <p>113. Describe changes in immune response that occurs with aging</p>
36	Allergy & Hypersensitivity	<p>114. Define allergy and allergen</p> <p>115. Describe the pathophysiology of allergy and hypersensitivity</p> <p>116. Define and classify the hypersensitivity reaction</p> <p>117. Compare the immediate and delayed hypersensitivity reactions</p> <p>118. List the diseases associated with hypersensitivity reactions</p>
Biochemistry		
37	Immunoglobulin's / Antibodies	<p>119. Define Immunoglobulin's</p> <p>120. DESCRIBE Types of Immunoglobulin's</p> <p>121. Describe Structure of Immunoglobulin's</p> <p>122. Describe the mechanism of action of antibodies</p> <p>123. Explain biochemical role of each immunoglobulin in immunity</p>
COMMUNIUTY MEDICINE		
38	Vaccinology	<p>146. Define vaccine and immunization</p> <p>147. Explain the expanded program of immunization (EPI) in Pakistan</p>
LAB WORK		
PHYSIOLOGY PRACTICAL		
39	TLC determination	148. Determine the total leukocyte count (TLC) in the given sample
40	DLC determination	149. Determine the differential leukocyte count (DLC) in the given sample

THEME -III

Excessive Bleeding

PHYSIOLOGY

SNO	Topic	Learning Outcome
41	Introduction to hemostasis	150. Describe the structure, function, life span and normal count of Platelets. 151. Define hemostasis 152. Describe the role of platelets in hemostasis 153. Outline the sequence of processes involved in hemostasis.
42	Blood Coagulation	154. Enlist the clotting factors 155. Explain the role of calcium in coagulation 156. Explain how clotting is prevented in the normal vascular system 157. Outline the sequence of processes during blood coagulation 158. Describe with the help of a flow diagram (or draw) intrinsic pathway of coagulation cascade 159. Describe with the help of a flow diagram (or draw) extrinsic pathway of coagulation cascade 160. Explain how the mechanism of clot dissolution.
43	Bleeding disorders	161. describe the role of Vit K in clotting 162. Describe the following bleeding disorders

		<ul style="list-style-type: none"> - Vitamin K deficiency - Thrombocytopenia - Hemophilia <p>163. Define Von Willebrand disease</p>
44	Thrombotic disorders	<p>164. Describe the effects of low platelet count on Hemostasis</p> <p>165. Define thrombus/thrombi</p> <p>166. Define emboli/embolus</p> <p>167. Enlist the causes of thromboembolic conditions</p> <p>168. Describe Femoral venous thrombosis and pulmonary embolism</p>
Pharmacology		
45	Coagulation modifying drug	<p>169. Identify the site of action of following drugs in coagulation cascade</p> <ul style="list-style-type: none"> • Aspirin, • Heparin, • Tranexamic acid • Vit K
LAB WORK		
46	Clotting time determination	170. Determine the clotting time
47	Bleeding time determination	171. Determine the bleeding time
48	Prothrombin time determination	172. Determine the Prothrombin time (PT) in the given sample

THEME -IV

Transfusion Reaction

SN0	Topic	Learning Outcome
PHYSIOLOGY		
49	Blood Grouping	<p>173. Describe different types of blood groups</p> <p>174. Describe the genotype-phenotype relationships in blood groups.</p> <p>175. Interpret the plausible blood groups (A-B-O) in children of parents with known blood groups.</p> <p>176. Describe the role of agglutinogens and agglutinins in blood grouping</p> <p>177. Describe the antigens and antibodies of the O-A-B blood types/ Interpret the types of agglutinins present in individuals with a specific blood group</p> <p>178. Describe the process of agglutination</p>
50	transfusion reactions	<p>179. Describe the antigens and antibodies of the Rh system</p> <p>180. Describe the principles of blood typing</p>

		<p>181. Explain universal donor and universal recipient blood groups</p> <p>182. Enlist the manifestations of transfusion reaction</p>
51	Erythroblastosis fetalis	<p>183. Define Rhesus incompatibility</p> <p>184. Describe erythroblastosis fetalis</p> <p>185. Describe the transfusion reactions resulting from mismatched O-A-B and Rh blood types</p>
52	Major histocompatibility complex	<p>186. Define autoimmunity</p> <p>187. Explain how immune reaction to self-antigens is avoided</p> <p>188. Define and classify Major Histocompatibility complex (MHC)</p> <p>Characterize the significance and function of major histocompatibility complex molecules</p>
Forensic Medicine		
53	Medico-legal importance of blood groups	<p>189. Describe the Medico-legal importance of blood groups in forensic work that is</p> <p>(a) Personal Identity</p> <p>b) inheritance claims</p> <p>(c) DNA profiling</p> <p>(d) Disputed paternity and maternity</p>
COMMUNITY MEDICINE		
54	epidemiology of blood borne diseases	<p>190. Identify important blood borne pathogens and how they are spread</p> <p>191. Discuss the epidemiology of blood borne disease transmission and the potential for HIV, HBV and HCV transmission.</p> <p>192. Identify routes of transmission of blood borne pathogens</p> <p>193. Discuss the best practices to perform safe blood transfusion.</p> <p>194. Identify potential exposure risks</p>

		195. List important safeguards against blood borne pathogen disease
LAB WORK (Physiology Practical)		
55	Blood grouping	196. Determine the O-A-B and Rh blood group in the given sample
56	Blood smear preparation	197. Prepare blood smear by thumb prick method.
70	Blood Bank	198. Observe the process of blood donation, blood product separation, screening and storage and observe the process of blood transfusion.