SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH
(A Deemed to be University Declared under Section 3 of UGC Act, 1956)
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(With effect from 2021-22 batch)

Curriculum for Fellowship in Immunohematology & Blood Transfusion

Approved as per AC-38-2021,(Resolution No-XXXVIII-11/21 Dated-02/06/2021

Fellowship Programme
Immunohematology and Blood Transfusion

RL Jalappa Hospital Blood Bank
(Under Department of Pathology, SDUMC Tamaka, Kolar).

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GUIDELINES FOR FELLOWSHIP

PREAMBLE:

Blood Banking and immunohematology is a unique multi-dimensional specialty that incorporates elements of blood banking, immunohematology, coagulation, and hematology and integrates science technology, medicine, public health administration and the community as a whole. Because transfusion therapy has strong interrelationship with several other disciplines, particularly hematology and immunology, training programs in transfusion medicine must include appropriate knowledge and skills in these subjects.

GOAL:

The goal of this fellowship is to enable the fellow to acquire the skills and knowledge to be a competent transfusion medicine specialist. This document will provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by subject-content specialists.

SUBJECT SPECIFIC OBJECTIVES : (Program Outcome)

Fellow at the end of fellowship programme will be able to:

(a) Monitor transfusion practices of fellow clinicians and advise them on the management of patients needing sophisticated transfusion services,

(b) Be well versed with Regulatory requirements,

(c) Be competent to establish transfusion services commensurate with international standards,

(d) Be equipped to manage an adequate and safe blood supply and

(e) Interact closely with clinicians in the hospital to ensure optimal and

appropriate use of blood and blood components as well as availability of transfusion alternatives.

DURATION OF THE PROGRAMME: One year (12 Months)

MODE OF STUDY: Full time.

NUMBER OF CANDIDATES PER YEAR: 02

SUBJECT SPECIFIC COMPETENCIES

The functioning of an Immuno hematologist will be as per basic principles as listed below:

1. Person centered care
2. Blood Safety
3. Comprehensive care in collaboration with Clinicians

By the completion of the course, the Fellow must demonstrate the ability to:

1. Identify the need for appropriate blood and blood components for transfusion.
2. Perform all necessary laboratory investigations before blood and its components are used to ensure safety of blood products and absence of Transfusion Transmissible Diseases,.
3. Diagnose a case of mismatched blood transfusion

By achieving the above competencies, the training must enable him/her to play the following major roles:

1. Clinician
2. Communicator
3. Leader & member of a team

SPECIFIC LEARNING OBJECTIVES

At the end of the course, the fellow should have acquired knowledge in the following:

A. Cognitive Domain

I. Basic Sciences (Immunology, Medical Genetics, Hemostasis & Physiology of Formed Elements of blood)

- Demonstrate familiarity with the current concepts of structure and function of the immune system, its aberrations and mechanisms thereof. The fellow should be able to demonstrate understanding of the basic principles of immunoglobulins, antigen, antibody and complement system, antibody development after immunization and infection.
- Understand the basic concepts and their clinical relevance of the following:
  - Mechanisms of acute inflammation
  - Healing and repair
  - Physiology of Immune System
  - Hypersensitivity reactions
  - Autoimmunity
  - Transplantation Immunology
- Demonstrate familiarity with the scope, principles, limitations and interpretations of the results of important procedures employed in clinical and experimental studies relating to immunology – this is inclusive of but not limited to:
  - ELISA techniques
  - Radioimmunoassay
  - HLA typing
  - Hybridoma technology
  - Isolation of T & B lymphocytes
  - CD4 / CD8 count
  - Microlymphocytotoxicity test
  - Cellular assays

II. Blood Collection / Component Processing

The fellow should be able to demonstrate understanding of the processes associated with Blood Donor motivation (motivation strategies), recruitment, selection and proper donor care in blood center as well as in outdoor blood donation camps and be able to understand importance of cold chain maintenance. The fellow should:

- Be able to understand donor counseling and notification (Pre- and Post-donation).
- Be familiar with various categories of blood donors including autologous and directed donors and be able to know their clinical relevance.
- Be familiar with various "storage lesions" in blood components, factors affecting the storage lesions and its prevention.

III. Transfusion transmitted infection

- Be able to understand various strategies for improving blood safety in general and TTI testing in particular pertaining to Indian conditions.
- Be able to understand the typical time course of appearance and disappearance of serum antigens and antibodies used in screening of major transfusion transmitted infection, including HIV, hepatitis B, hepatitis C, syphilis and malaria and others.
- Demonstrate understanding of the new emerging threats (including Prions, vCJD, Lyme Disease, West Nile Virus, Dengue, Chikungunya etc.) to blood supply in the country including bacterial contamination, their detection and prevention.

IV. Immunohematology / Blood Group Serology / Compatibility testing

- Demonstrate understanding of the knowledge of various major and minor blood group systems including their biosynthesis, antigen/antibodies, phenotype/genotype frequency, clinical significance.

- Demonstrate understanding of the various Immunohematological laboratory tests including
- Be able to understand the pathophysiology, clinical features, lab diagnosis & management of Rh, ABO and other blood group incompatibility in antenatal patients including exchange transfusion / intra-uterine transfusion.

V. Clinical Transfusion Service

Demonstrate knowledge of the principles of patient/ unit identification and its importance in blood safety.

- Understand the principles of blood inventory management.
- Demonstrate understanding of the rational use of blood and components in various clinical conditions including monitoring of transfused patients.
- Demonstrate understanding of the major non-infectious complications of blood transfusions, including red cell alloimmunization, transfusion-related acute lung injury, transfusion associated graft versus host disease, volume overload, post transfusion purpura, iron overload etc. and the risk of these complications, and strategies to prevent them. Fellow should have knowledge of pathophysiology, clinical features, diagnosis and management of these conditions.

VI. Therapeutic Apheresis, Therapeutic Plasma Exchange and Cytapheresis

- Understand the principles of apheresis technology, including centrifugation, filtration, and immunoadsorption.
- Demonstrate knowledge of the indications for therapeutic apheresis including cytapheresis and of the appropriate replacement fluids to be used in various situations.

VII. Regulatory Skills / Quality Assurance/ Quality Control in blood transfusion

- Demonstrate knowledge concerning the requirements and applications of all applicable regulatory and accrediting agencies. [e.g., DCGI, NABH, AABB].
- Become familiar with the patient / blood donor privacy and data security requirements, including the use of Institutional Review Board (IRB) protocols for conducting clinical research, for conducting stem cell research- ICSCRT (Institutional Committee for Stem Cell Research and Treatment).

B. Affective Domain

I. Basic Sciences (Immunology, Medical Genetics, Hemostasis & Physiology of Formed Elements of blood)

The Fellow should:

- Demonstrate honesty and integrity in all interactions.
- Demonstrate responsibility and excellence in ongoing professional development
- The Fellow should demonstrate professionalism in taking a history from a blood donor.

II. Blood Collection / Component Processing

The Fellow should:

- Be able to function as a part of a team that is essential for the selection and management of a blood donor. She/he should therefore develop an attitude of cooperation with colleagues so necessary for this purpose. It is implied that she/he will, whenever necessary, interact with the blood donor, patient, clinician and other colleagues to provide the best possible blood transfusion support, diagnosis or opinion.
- Demonstrate professionalism during blood donor selection, counseling and notification. Always adopt ethical principles and maintain proper etiquette in her/his dealings with blood donors, outdoor camp organizers and other health personnel.

- Respect the rights of the blood donor including the right to information and maintaining confidentiality.

III. Transfusion transmitted infection

The Fellow should:

- Respect the rights of the sero-positive blood donor including confidentiality, right to information.
- Adopt ethical principles and maintain proper documentation while interacting with other inter related labs such as ICTCs, counselor, state AIDS Control Societies etc.

IV. Immunohematology / Blood Group Serology / Compatibility testing

The Fellow should:

- Should be able to interact with clinical colleagues in professional manner to provide best possible transfusion support and opinion in immunohematological problems.
- Demonstrate improvement in the affective traits of organizational skills, work habits, attitude, interpersonal skills, and problem-solving ability.

V. Clinical Transfusion Service

The Fellow should:

- Be able to function as a part of a team that is essential for the diagnosis and management of a patient. She/he should therefore develop an attitude of cooperation with colleagues so necessary for this purpose.
- Accept constructive criticism as a learning process. Utilize constructive criticism to correct deficiencies and improve performance

VI. Therapeutic Apheresis, Therapeutic Plasma Exchange and Cytapheresis

- **The Fellow should** communicate effectively with clinicians and patients regarding emergent or scheduled therapeutic apheresis procedures through conversations and writing of consult notes.

C. <u>Psychomotor Domain</u>

At the end of the course, the Fellow should acquire the following skills:

- Demonstrate competency in performing & interpretation of various methods of hemoglobin estimation and complete hemogram.
- The Fellow should be able to demonstrate competency in preparation and interpretation of peripheral blood smear in health and disease conditions – inclusive of but not limited to:

  - Nutritional (Iron deficiency/Vit B12 and Folic acid deficiency) anemia
  - Hemolytic anemia (Immune , Sickle Cell, Thalassemia, Microangiopathic)
  - Thrombocytopenia
  - Acute leukemia
  - Chronic leukemia
  - Hemoparasites
  - Myelodydpastic syndromes
  - Myeloproliferative disorders

Blood Collection/Blood Center/Component Processing

The Fellow should:

- Demonstrate competency in various types of autologous blood collection and their application in clinical transfusion service
- Demonstrate proficiency in collection of whole blood with regard to preparation of phlebotomy site, proper volume and sample collection in minimum 500 donors.
- Demonstrate proficiency in performing leuko-filtration in at least 05 blood components

Transfusion transmitted infection

The Fellow should be able to:

- Compare & contrast various methodologies such as ELISA, rapid & chemiluminescence used in screening of transfusion transmitted infections.
- Demonstrate proficiency in performing, interpretation, documentation of at least 500 blood donor screening tests for TTIs as per departmental SOP.

Immunohematology / Blood Group Serology / Compatibility testing

The Fellow should be able to:

- Demonstrate proficiency in preparation of cell suspensions of appropriate concentration following cell washing techniques correctly & grade and interpret antibody-antigen reactions according to the established criteria.
- Demonstrate proficiency in performing ABO/Rh grouping in at least 500 donor / patient samples using department SOP.

Clinical Transfusion Service

The Fellow should be able to:

- Demonstrate proficiency in evaluating and recommending treatment plans for minimum of 10 transfusion reactions.
- Be able to identify irregular antibodies in pregnant patients that are clinically significant and make appropriate recommendations for blood

products. Demonstrate proficiency in preparation and transfusion of blood for intrauterine transfusion / exchange transfusion.

Therapeutic Apheresis, Therapeutic Plasma Exchange and Cytapheresis

The Fellow should be able to:

- Demonstrate proficiency in evaluating and preparing patients for therapeutic apheresis, including discussion with the patient of the risks and benefits associated with apheresis procedures and obtaining informed consent.
- Demonstrate proficiency in the treatment of patients using specialized methods (e.g., photopheresis and immunoadsorption columns).

Regulatory Skills / Quality Assurance/ Quality Control in blood transfusion

The Fellow should be able to:

- Demonstrate proficiency in preparing at least 05 SOP for the department.
- Be able to understand proper use of instrumentation and computerization in a transfusion laboratory.
- Compare and contrast the various means of performing blood utilization reviews.

SYLLABUS

Course contents:

I. History of transfusion medicine

I.1 Scientific landmarks in its development

I.2 Impact of world wars on its development

II.Scientific basis of transfusion

A. Biochemistry & physiology of elements of blood

2.0 Process of cell production and life span

2.1 red cells

3.0 Red cells

3.1 Hemoglobin structure & function

3.2 Metabolic pathways

4.0 White cells

4.1 Structure, function & kinetics

5.0 Platelets

5.1 Structure, function & kinetics

6.0 Physiology of haemostasis

6.1 Role of platelets

6.2 Coagulation pathways

7.0 Hemodynamics of blood flow & volume

8.0 Iron metabolism

B.IMMUNOLOGY

10. Principles of basic immunology

10.1 Antigen, antibody, complement, immunoglobulin

10.2 Antigen antibody reaction

11. Role of hybridoma technology in Immunohematology

12. Immunology of transplantation

C.GENETICS

14. Principles of basic genetics

15. Genetics of blood groups

III.Antigen systems in formed elements of blood

16. Red cell antigens

17. Leucocyte antigens

IV. Blood collection, processing, component Preparation

A. Management of blood donation

19. Donor recruitment

19.1 Voluntary blood donation systems

19.2 Categories of blood donors

20. Acceptability criteria of blood donor

21. Care of blood donor

21.1 Pre-donation

21.2 Mid-donation

22. Blood collection

22.1 Anticoagulants & preservatives

22.2 Procedure for collection and storage

B. Blood components

23. Components 23.1 Types

23.2 Methods of preparation

23.4 Leucodepletion

23.4.1 Various methods

24. Storage of blood & components

24.1 Whole blood

24.2 Red cell concentrate

24.3 Plasma

24.4 Granulocyte

25. Plasma fractionation

25.1 Viral inactivation

25.1.1 Single donor

26. Compatibility testing

26.1 ABO grouping & Rh typing

26.2 Antibody screening

26.3 Cross matching methods

26.4 Newer methods of cross matching

27. Screening for transfusion transmitted infections

27.1 Methodology

27.2 Nucleic acid amplification techniques

27.3 Newer emerging pathogens

27.3.1 Prions

28. Selection of blood, components & plasma products for transfusion

VI. Adverse effects of blood transfusion

29. Clinical presentation, pathophysiology, investigations, management

29.1 Hemolytic transfusion reaction

29.2 Non- Hemolytic transfusion reaction

30. Transfusion transmitted infections

30.1 Bacterial

30.2 Viral

31. Transfusion associated graft versus host disease

32. Others

33.1 Hemosiderosis

VII. Apheresis

34. Technology of apheresis, various equipment & disposables

35. Haemapheresis (platelets, granulocytes, plasma, stem cells)

35.1 Donor selection

36. Therapeutic apheresis

36.1 Indication, procedure & complications

36.2 Plasma exchange, red cell exchange

VIII. Autologuos transfusion

37. Basic principles, indication & contra indications

37.1 Pre deposit

37.2 Haemodilution

37.3 Intra operative blood salvage including equipment

IX. Antenatal and neonatal transfusion practice

38. Pathophysiology, diagnosis & management

38.1 Rh incompatibility

39. Exchange transfusion

39.1 Indications, methodology & complications

40. Neonatal transfusion practice

40.1 Strategies to reduce donor exposure

X. Immunohaematology

41. Classification, diagnosis & management

41.1 Immune hemolytic anemia

41.2 Immune thrombocytopenia

XI. Hemotherapy

43. Pathophysiology, diagnosis & management of anemia

43.1 Anemia

43.1.1 Iron deficiency anemia

43.1.2 Megaloblastic anemia

43.1.3 Aplastic anemia

43.2 Hereditary anemia

43.2.1 Thalassemia

43.2.2 Sickle cell anemia

44. Pathophysiology, diagnosis and management of hemostatic disorders 44.1 Hemophilia

44.2 Von Willebrand disease

44.3 Platelet disorders

44.3.1 Qualitative disorders

44.4 DIC/TTP/HIT

44.5 Acquired disorders

44.5 Others

45. Pathophysiology, diagnosis and transfusion support in acute blood loss 45.1 Shock

46. Transfusion support in surgery

46.1 General surgery

46.2 Specialised surgery –

47. Non-Hemopoeitic malignancy

XII. Transplantation

48. Transfusion support in transplantation

48.1 Stem cell transplantation

48.1.1 Harvesting

48.1.2 Cryopreservation

48.2 Bone marrow transplantation

48.2.1 Harvesting

48.2.2 Processing

48.2.4 Transfusion support BMT patients

48.3 Transfusion support in specialized conditions

48.3.1 Renal transplantation

48.3.2 Liver transplantation

49. Irradiation of blood products

49.1 Indications, dosage, adverse effects

XIII. Blood substitutes and hemopoietic agents

52. Crystalloids & colloids

53. Oxygen carrying compounds

54. Use of hematinics

55. Hemopoietic growth factors

56. Plasma products

XIV. Medicolegal considerations in transfusion medicine

57. Ethical and legal considerations pertaining to transfusion practice

58. Identification of blood stains
59. Paternity testing
60. Donor notification & counseling
61. Look back programme

XV. Total quality management

65. Development of Standard Operating Procedures (SOP) manual.
66. Quality control
    66.1 Reagents & diagnostic kits
    66.2 Instruments
67. Quality assurance
    67.1 Internal quality control
    67.2 External quality control
68. Hospital Transfusion Committee
69. Medical audit
70. Hemovigilance
71. Accreditation

XVI. Organisation & management of transfusion services

72. Organisation & function of blood services & hospital transfusion practice
    72.1 Recruitment & motivation
    72.2 Operation of blood mobile units
    .

XVII. Biosafety

    73.1 Personnel
    73.2 Laboratory
    73.3 Equipment

XVIII. **Modern biological techniques**

74. Principle, methods, relevance in transfusion medicine

74.1 Western blot

74.2 Polymerase chain reaction

74.3 Dot blot hybridization

74.4 Molecular basis of blood grouping

74.5 HLA typing

74.6 Stem cell harvesting

74.7 Other new technique in Transfusion medicine

XIX. Automation & computerisation

75. Instrumentation
76. Automated blood group & processing
77. Automated infectious screening

General orientation- Bio-statistics, computers, medical ethics, scientific presentations, publications, leadership qualities, cost effectiveness, preparation of reagents, handling equipments, educational technology.

TEACHING AND LEARNING METHODS

Teaching methodology

Teaching methodology includes:

1. Didactic lectures
2. **Seminar/journal club presentation (once a fortnight).**

   Evaluation sheets may be incorporated for the purpose of assessment of presentations. The following points may be considered in the scheme for evaluation of presentations.

- Topic selection
- Completeness of presentation
- Clarity of presentation
- Understanding of the subject and ability to convey the same
- Whether relevant references have been consulted
- Ability to convey points in favor and against the subject under discussion
- Proper use of audio-visual aids
- Ability to answer questions

3. **Case presentation, case work up, case handling/management (once a week)**

   Each Fellow in transfusion medicine presents an interesting case in clinical transfusion practice or in laboratory exercise of his or her choice.

4. **Attending clinical grand rounds / clinic-pathological conference**

   The Fellow are encouraged to attend lectures and grand rounds offered by other clinical and basic science departments of the hospital.

5. **Attendance at Scientific meetings, CME programmes**

   The Fellow are expected to attend meetings related to transfusion medicine present papers/posters in these meetings.

6. **Quality performance meetings:**

   The Fellow should attend meetings of hospital transfusion/blood usage committee, meetings to review transfusion service errors, variances, and incidents, mortality meetings, audit related meetings.

7. **Paper/poster presentation:**

   A Fellow would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period studies so as to make him eligible to appear at the examination**.**

8. **Teaching skills:**

The Fellow shall be required to participate in the teaching and training programme.

9. A **logbook** should be maintained recording the duration of posting, the period of absence, if any, skills performed, and remarks if any by the teacher/faculty member. The logbook should also record journal clubs, seminars attended and partaken as well as undergraduate teaching activities the Fellow has participated and should be signed by the faculty in charge.

11. Department should encourage **e-learning activities**

12. Rotation postings:

Title	**Content of training activities**	**Learning objective**
Orientation [1 week]	Brief orientation to computer system, blood bank activities, teaching program	Be conversant with computer system & operation of blood bank activities
Blood donation [2 months]	Donor recruitment & motivation, Donor selection Phlebotomy, Post donation care of donor, outdoor blood donation	Should be able to select the donor, perform phlebotomy with aspetic precautions, and manage donor reactions
Apheresis – donor and therapeutic [1 months]	Access evaluation, donor suitability, selection of machine, product manipulation, QC of product, donor observation for adverse effects and its management Indications, contra indications, replacement fluids, frequency, monitoring of TPE	Should be able to perform the procedure independently, obtain quality product and manage any adverse effects Should be able to select proper patient, machine, plan TPE, select replacement fluids and monitor the

		patient
Component preparation & QC [2 months]	Preparation of blood components. Product manipulation such as Leucocyte removal or Irradiation. Storage & quality control	Should be able to understand factors affecting quality of components,
Immunohaematology [2 months]	Diagnosis & transfusion support in AIHA, PNH Evaluation of transfusion reaction. Investigations in antenatal serology. ABO-Rh typing, antibody screening, identification, evaluation of positive DAT	Should be able to interpret immune hematological tests. Should be able to provide consultation to physicians regarding transfusion management
Pretransfusion testing & cross match [2 months]	Investigation of difficult cross match, formal consultation on transfusion support in complex cases, checking indications & dosage for blood components, emergent issue of blood, transfusion in special cases such as massive transfusion, organ transplantation, platelet refractoriness.	Should be able to provide consultation on transfusion therapy. Should be able to resolve difficult & complex cross matching problems. Ensure appropriate and judicial use of blood and components
Transfusion Transmitted infection screening, Quality control/ records [1 month 3weeks]	Screening for various markers such as HIV, HCV, HBs Ag, Syphilis. Methodology such as Elisa, spot, rapid, automated analyzer NAT techniques such as PCR, TMA. Laboratory safety Quality control of components, equipment, reagents. Quality assurance. Development ofdocuments, SOPs,	Should be able to understand blood screening principles and disposal of reactive units. Should be able to validate ELISA, maintain QC Should be able to understand QC principles, Recognize

	Regulatory compliance	common management & regulatory issues, identify management strategies

Training in allied departments:

Fellow should be sent for training for 8 months in allied laboratory and clinical departments, as below:

Laboratory areas subjects:

Section	Content
Haematology: 1 week	Complete hemogram Work up of hemolyticanemias Reading peripheral smear Bone marrow aspiration
Microbiology laboratory: **1 week**	ELISA, Western blot, PCR Bacteriology – Basic stains, Blood culture-aerobic, anaerobic, fungal
Clinical Department subjects: **2 Week** (Paediatrics, Neonatology, Medicine, ICU, Anaesthesia)	Transfusion support for thalassaemia, haemophilia, leukemia, solid organ transplantation Platelet transfusion therapy and its monitoring Neonatal exchange transfusion Bed side management of transfusion reactions Intraoperative hemodilution, Use of Cell saver, Intraoperative Blood salvage

<u>Project work under a guide</u>: Fellow will choose a relevant Blood bank subject and read a paper in a conference and prepare for publication during the

fellowship. The project work will be evaluated in the IInd semester examination by using 1 to 10 scale.

EVALUATION:

Formative assessment: There will be continuous evaluation and the competency is measured after each technique by observing and performance evaluation by allotting marks on a 1 to 10 scale with respect to techniques in each of the topics taught.

Summative assessment: By conducting examination in theory and practical in each semester.

Theory paper (10x10=100 marks)
Practicals (100 marks): Case based analysis / evaluation, which involves processing samples, performing tests and interpreting results.
Total marks: 200 Marks (In each semester)

There will be internal and external examiners.
Results: Pass class fellow must secure 50% in both internal assessments and Theory & practical separately. Ist class =/>66% and Distinction=/> 75%.

GOVERNANCE:

Course in-charge: HOD, Department of Pathology

Course Coordinator: Blood bank officer

Training provider & Teaching activity: Qualified teaching staffs of Department of Pathology.

SELECTION CRITERIA:

Eligibility: 1. MD in Pathology

2. DNB in Pathology
3. Diploma in Clinical pathology
4. MBBS with 5 years experience in blood bank

FEE STRUCTURE: Course fee Rs 90,000/- and the candidate will be paid Rs 25,000/- per month as stipend.

VENUE OF TRAINING: Department of Pathology SDUMC Tamaka, Kolar and RLJH blood bank Tamaka, Kolar.