Curriculum for

Post-Doctoral Fellowship Course

in

Fetal Medicine

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**SRI AUROBINDO UNIVERSITY**

SAIMS HOSPITAL CAMPUS, Indore Ujjain, State Highway, Bhawrasla, Indore, Madhya Pradesh 453555

***FETAL MEDICINE CURRICULUM***

The maternal and fetal medicine fellowship program run under the prestigious Sri Aurobindo University aims to train fellows in this subject. The program ensures that the fellows acquire adequate knowledge and develop essential skills to meet program expectations. During the program tenure the fellows shall be evaluated quarterly by the supervising faculties, and this shall be taken into consideration at the end of evaluation. In addition, the fellows can equally give their feedback to the faculties whether there educational need are being met.

Duration:

The fellowship program is for a duration of 2 years with rotatory postings in various departments.

1. Labor and delivery wards
2. High risk pregnancy OPD
3. Fetal medicine center/ Prenatal diagnosis center
4. Genetic Counselling- Overview and insight into case specific tests
5. Training in Obstetric anesthesia
6. Setting up and case management in Obstetric ICU
7. Antepartum and intrapartum fetal surveillance
8. Ultrasound training modules for
9. Basic obstetric ultrasound scan
10. Advanced ultrasound scans which include Nuchal translucency scan, Anomaly scan, Genetic Sonogram, and Growth scans.
11. Ultrasound in labor
12. Invasive fetal / Intrauterine procedures- Amniocentesis, Chorionic villous sampling, Fetal reduction, pleurocentesis and vesicocentesis, Amniodrainage and fetal blood sampling.
13. Multiple pregnancy clinic
14. Fetal growth restriction clinic
15. Fetal Cardiology Clinic
16. Placental Clinic for women suffering from disorders of abnormal placentation
17. Preterm birth clinic
18. Journal Club- Interdepartmental review meeting with department of Neonatology, Pediatric surgery, Hematology and Intensive care medicine.
19. Simulation curriculum- the maternal and fetal medicine has developed a simulation curriculum to reinforce core learning objectives. The fetal therapy portion of the simulation program uses innovative models to help fellows acquire facility with transabdominal and transvaginal procedures like chorionic villous sampling, amniocentesis, fetal blood sampling and fetal reduction. The critical maternal care portion of the program focuses on developing fellows role as a team leader in acute care of the pregnant patient. Simulators are often multidisciplinary and promote a team based approach to managing scenarios such as hemorrhage, hypertensive crisis, eclampsia, cardiac arrest and sepsis.

The program shall start with basic training modules and progress later to advanced training modules. The curriculum shall follow in the following steps:

CLINICAL MODULE I

Skills acquired:

Ultrasound use to screen for and manage pregnancy complications other than fetal abnormalities. The skills that shall be acquired include-

1. Optimization of images for 2D and Doppler ultrasound
2. Perform Doppler investigations and scans
3. Understanding fetal growth and differentiating between early and late onset FGR
4. Define and recognize chorionicity and understand the management protocol for types of multifetal gestation. Special protocols and management of pregnancies complicated by growth discordance and TTTS.
5. Provide care to women with red cell alloimmunization recognizing when there is a need for increased fetal surveillance and fetal intervention.
6. Protocol for management of women who have experienced mid trimester fetal loss and extreme preterm birth.
7. Diagnose and manage low lying placenta and abnormal placentation.
8. Define, recognize, investigate and manage disorders of amniotic fluid volume.
9. Using ultrasound to define fetal position in advanced stages of labor (Intrapartum ultrasound).

Knowledge criteria:

1. Risks associated with different ultrasound modalities
2. How to use the ultrasound machine, its knobology, the optimization of power, gain, focal length, magnification, frame rate, pulse repetition frequency, color and power Doppler modes.
3. Use of 3D/ 4D ultrasound
4. Use of Doppler ultrasound and its interpretation
5. Doppler assessments to assess fetal growth restriction time delivery and detect fetal anemia.
6. Understanding how fetal anemias may influence the Doppler waveforms (eg cardiac arrhythmias, fetal anemia, hydrops, and TTTS
7. Use of MCA velocities to monitor fetal anemia
8. Understanding red cell antibodies and they may result in hemolytic disease of fetus and newborn.
9. Causes, associations, recurrence risks and preventive strategies for mid trimester fetal loss and preterm labor
10. Understanding the measurement of cervical length
11. Indications, complications and type of cervical cerclage
12. Defining growth discordance in multiple pregnancies and importance of chorionicity
13. Definition of oligohydramnios and polyhydramnios and the differential diagnosis.
14. Clinical and ultrasound features of TTTS and referral triggers for referral to higher level fetal medicine units.
15. Management of low-lying placenta and placenta previa
16. Risk factors for abnormal placental invasion and vasa previa and their diagnosis with ultrasound
17. Ultrasound features of TRAP (Twin reverse arterial perfusion sequence) and TAPS (Twin anemia polycythemia sequence)

MODULE II- Deals with screening of fetal anomalies

Skills acquired:

1. To understand normal structural findings in all trimesters and recognize if normality is not demonstrated.
2. Should be able to understand normal anatomy planes for assessment of each system
3. Counsel regarding prenatal investigations. Their scope, limitations and interpretation of results.
4. Counselling and managing pregnancies complicated by fetal anomalies. Advice appropriate tests, and monitoring in such cases.
5. To give appropriate advice regarding fetal risks, implications for the pregnancy and long term outcome.
6. To plan birth and appropriate neonatal support in collaboration with neonatologist.
7. Counsel and management for termination of pregnancy
8. To explain the role of fetal autopsy and other relevant post birth tests.
9. Counselling regarding recurrence risks and specific future pregnancy management
10. Evaluation of pregnancies complicated by red cell alloantibodies
11. Evaluation of pregnancies complicated by non immune hydrops fetalis and relevant inestigations.

Knowledge criteria:

1. Normal ultrasound appearance of fetal CNS, face, cardiovascular system, abdominal wall, GIT, urogenital tract, fetal skeleton and extremities.
2. Understanding normal embryology and its variations
3. Normal fetal behavior and activity
4. Diagnostic features of structural fetal abnormalities
5. Genetic basis of common aneuploidies and associated ultrasound features
6. Understanding when to offer invasive testing
7. Role of Noninvasive prenatal testing
8. Recognizing the need to offer genetic tests
9. Explain the common modes of Mendelian inheritance and how they determine chances of recurrence.
10. Implications for current pregnancy and long-term prognosis of fetal abnormalities
11. Antenatal management, intrapartum care and immediate postnatal management of each condition
12. Local prenatal, birth and post birth pathways
13. Investigate for suspected fetal infections and correct interpretation of these tests.
14. To discuss the potential fetal, newborn and long-term effects of fetal infections
15. Understanding various soft markers noted on ultrasound and its management
16. Understanding fetal ventriculomegaly and the thresholds for diagnosing mild, moderate and severe ventriculomegaly and the implications of each.
17. Role of fetal MRI for diagnosing CNS lesions.
18. Common fetal arrhythmias and role of pediatric cardiologist in management
19. Different types of VSD and their association with cardiac, extra cardiac and chromosomal abnormalities.
20. Ultrasound features of various cardiac and CNS anomalies and their association with other structural and chromosomal abnormalities.
21. Ultrasound features of GI atresia, associations and surgical options following birth.
22. Echogenic bowel- its association with chromosomal abnormalities, cystic fibrosis, viral infections and growth restriction.
23. Urinary tract obstruction and renal dysplasia-understanding etiology, postnatal investigations and short- and long-term implications.
24. Findings suggestive of lethal skeletal dysplasia
25. Neonatal implications of anemia, hyperbilirubinemia and hydrops

MODULE III – Invasive procedures

Skills acquired:

1. Obtaining informed consent for invasive procedures- chorionic villous sampling, amniocentesis, fetal reduction and fetal blood sampling.
2. Clearly indicating the need for procedure
3. Discuss how and when the results will be given
4. Appropriate advice following procedure
5. Management of complications following amniocentesis

Knowledge criteria:

1. Understanding indications for invasive testing
2. Types of genetic tests that may be applied in case specific scenarios- QF-PCR, karyotype, array analysis and molecular testing in case specific situations.
3. Administration of Anti D to Rh negative mother’s post procedure to prevent sensitization
4. Implications of maternal blood born viruses in performing procedures
5. Technique of performing various procedures
6. Options available in case of test failure, mosaicism and the role of parental genetic analysis in special case scenarios.

MODULE IV: Common medical conditions in pregnancy

Skills acquired:

Assessment of presenting complaints with appropriate investigation and differential diagnosis

Recognizing the complexity and need for referral to subspecialist services.

Knowledge criteria:

1. Understanding pathophysiology, presentation and implications for maternal and fetal health of common maternal conditions presenting at booking.
2. Interpretation of ECG’s, chest X rays and blood gas analysis and how they are influenced by pregnancy.
3. Physiological changes in pregnancy and how the results of investigations are influenced by it and their correct interpretation.
4. Understand the presentation, investigation, differential diagnosis and management in pregnancy:

* Acute renal impairment
* Acute chest pain
* Breathlessness
* Ketoacidosis
* Altered consciousness
* Sickle cell crisis

MODULE V: management of intrapartum medical complications and pre-existing conditions.

Skills acquired:

1. Management of hypertensive disorders in pregnancy
2. Intrapartum care of women with diabetes
3. Care of women with pre-existing medical disorders- haemoglobinopathy, epilepsy, hepatitis B and C, HIV, herpes, cardiac, respiratory and renal disease, previous thromboembolism or elevated chances of VTE.
4. Assessment and management of critically ill or collapsed women- to make rapid differential diagnosis and start immediate resuscitation with involvement of MDT.

Knowledge criteria:

1. Management protocol for certain common scenarios that complicate intrapartum care.

-Severe pre-eclampsia

-Eclampsia

-HELLP syndrome

-Type II DM with or without complications

-Gestational diabetes

-Renal disease

-Haemoglobinopathies

-HIV

-Previous thrombo-embolic disease

-Elevated chance of VTE

-Intrapartum pyrexia

-Increased chances of early onset sepsis in neonate

1. Monitoring and optimization of Blood pressure control in labor
2. Monitoring and optimization of blood glucose control in labor
3. Management of hypoglycemia and ketoacidosis
4. Quantification of thrombo-embolic risks and its mitigation in labor and puerperium
5. Management of seizure disorders and eclampsia in labor
6. Optimization of fetal and maternal outcomes in women with renal, cardiac and respiratory diseases.
7. Impact of maternal viral infections on intrapartum and postpartum care of women with HIV, Hepatitis B , Hepatitis C and herpes.
8. Minimizing the risk of vertical transmission and pharmacological management
9. Indications for care of women in ICU and high dependency care units
10. Learning methods of invasive monitoring for oxygenation, acid base balance, intraarterial pressure, cardiac output, preload and contractility.
11. Risk factors, causes of and presentation of amniotic fluid embolism, pulmonary embolism, cerebrovascular accident and cardiac event during labor.
12. Causes of acute maternal collapse
13. Indications, timing and guidance of peri mortem caesarean section.

MODULE VI: Management of intrapartum key case scenarios and use of technical skills.

Skills acquired:

The following case scenarios shall be included.

1. Management of non-cephalic presentation safely
2. Preterm births
3. Multiple pregnancy
4. Rotational vaginal birth
5. Birthing in morbidly obese women
6. Management of post-partum hemorrhage
7. Management of morbidly adherent placenta
8. Maternal sepsis
9. Stillbirth
10. Labor analgesia and anesthesia
11. Caesarean section

Knowledge criteria:

1. Fetal and maternal risks and benefits associated with different modes of birth for breech presentation.
2. Maneuvers used during breech birth
3. Pathophysiology, investigations, risks and management of preterm labor and PPROM.
4. Diagnosis and management of chorioamnionitis
5. Indications, pharmacology and adverse effects of tocolysis, steroids and magnesium sulphate.
6. Discuss mode of birth in twin pregnancy and risks associated with either birth option.
7. Role of intrapartum ultrasound and CTG monitoring for multiple pregnancies.
8. Importance pf fetal growth restriction, discordant growth, prematurity, chorionicity and malpresentation for different modes of birth.
9. Techniques available to facilitate both vaginal birth and caesarean section.
10. Indications and contraindications for each form of operative vaginal birth.
11. Definition, diagnosis and outcomes of hypoxic ischemic encephalopathy.
12. Principles of advanced neonatal resuscitation
13. Neonatal acid base balance
14. Fetal macrosomia and its implications on birth options.
15. Etiology, presentation, risks, investigations and management of maternal sepsis.
16. Antibiotics suitable for use in pregnancy and postpartum.
17. Risk factors for PPH and minimizing the chances of PPH.
18. Correction of uterine inversion
19. Investigation of possible abnormal placental invasion. Its features on ultrasound and MRI.
20. Protocol for management of abnormal adherent placenta
21. Intraoperative measures to minimize blood loss in abnormal placental invasion.
22. Indications and timings of obstetric hysterectomy
23. Investigations that may determine the cause of antepartum stillbirth including the option of postmortem examination and karyotyping.

MODULE VII: Use of ultrasound to optimize outcomes during labor and immediate puerperium.

Skills acquired:

1. To determine fetal position and presentation
2. To confirm fetal viability intrapartum
3. Confirms intrauterine fetal demise
4. Identifies fetal occiput orientation intrapartum
5. Recognize normal and abnormal appearances of puerperal uterus.

Knowledge criteria:

1. To identify fetal lie and presenting part (cephalic, breech, flexed or extended breech, footling as well as shoulder presentation.
2. Intracranial landmarks which help in determination of fetal head position and occiput position.
3. To recognize and record ultrasound features of viable fetuses and intrauterine demise.
4. Physiological appearance of normal intrapartum uterus and that of retained products of conception.

MODULE VIII: Management of women with pregnancies complicated for fetal concerns.

Skills acquired:

1. Management of rare fetal structural malformations
2. Fetal hydrops
3. Management of rare complications of multiple gestations
4. Pregnancies at high risk of fetal alloimmune disorders
5. Offer and provide termination of pregnancy at suitable gestational age.

Knowledge criteria:

1. Embryology of all key fetal anatomical systems.
2. Pathology of all major anomalies affecting each fetal system

* Encephalocele, holoprosencephaly, microcephaly, intracranial mass
* Cardiac tumors
* Renal cystic disease, duplex kidney, bladder/cloacal exstrophy
* Laryngeal/ tracheal atresia, pulmonary sequestration, pleural effusion
* Meconium ileus, hepatic calcification/mass, abdominal cysts, ascites
* Cystic hygroma, micrognathia, macroglossia, anophthalmia, neck mass
* Fetal akinesia/ hypokinesia sequence
* Sacrococcygeal teratoma

1. Diagnostic features of each condition, their differential diagnosis and the probability of associated structural, chromosomal and syndromic associations.
2. To discuss outcomes, prognosis and recurrence risks with each condition.
3. Antenatal, intrapartum and immediate postpartum management of each condition.
4. Conditions amenable to prenatal therapylike fetal arrhythmias, spina bifida, CDH etc and associated complications with these treatment options.
5. Differential diagnosis of fetal hydrops
6. Differential diagnosis of fetal anemia
7. Hemolytic disease of newborn- threshold for commencing fetal surveillance and treatment
8. Incidence and pathogenesis of abnormal twinning resulting in TTTS, TRAP sequence and conjoined twins.
9. Treatment options for above mentioned pathologies and their pros and cons.
10. Risks associated with co twin demise in monochorionic and dichorionic gestations.
11. Techniques used for selective termination of pregnancy in multiple gestations.
12. Techniques for reduction of higher order multifetal pregnancies and their impact on the pregnancy.

MODULE IX: Application of clinical and molecular genetics in management of complex pregnancies.

Skills acquired:

1. Management of a pregnancy at a higher chance of or affected by aneuploidy.
2. Manage a pregnancy with a chance of a single gene disorder in a structurally normal fetus.
3. Diagnose and manage syndromic disorders in a structurally abnormal fetus.
4. Use of wide range of molecular, cytogenetic and biochemical tests for prenatal diagnosis in appropriate clinical setting.

Knowledge criteria:

1. Normal structure and function of chromosome and gene.
2. Pattern of genetic inheritance and susceptibility, expression, penetrance, multifactorial and mitochondrial inheritance
3. Types of aneuploidies including structural rearrangements, deletions and common microdeletions, trisomies, sex chromosome anomalies, extra markers, mosaicism (fetal and placenta), uniparental disomy, triploidy.
4. Underlying genetic etiology of single gene disorders and the following conditions:

* Myotonic dystrophy
* Huntington’s disease
* Haemoglobinopathies, hemophilia and other common bleeding disorders
* Inborn errors of metabolism

1. Detailed knowledge of following syndromes and associations

* Di George
* Fryn’s
* Beckwith-Wiedmann
* Meckel Gruber
* VATER/ VACTERL

1. Pre and postnatal phenotypes of common aneuploidies, single gene disorders and syndromes.
2. Screening modalities for aneuploidies, including ultrasound, biochemistry, and non invasive DNA based techniques.
3. Interpretation of recurrence risks for chromosomal and single gene disorders.
4. Prenatal testing options both invasive and non invasive including ultrasound, MRI, NIPT, amniocentesis, chorionic villous sampling and fetal blood sampling.
5. Laboratory techniques for analyzing prenatal and fetal samples, including PCR, FISH, Karyotyping. Microarray, mutational analysis, sequencing, enzymatic analysis and analyte assessment.