

**GUIDE TO LEARNING
IN
MATERNAL-FETAL MEDICINE**



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I. INTRODUCTION

The *Guide to Learning in Maternal-Fetal Medicine* (MFM) has been developed by The American Board of Obstetrics and Gynecology, Inc. (ABOG) to assist both the fellow in training and the Program Director. The basic educational needs that lead to appropriate achievement are presented; however, this description should not be misinterpreted as outlining the ideal or setting limits on learning or achievement.

This *Guide* is comprised of educational objectives and serves as:

1. The curriculum for an adequate fellowship training program, and
2. A study guide for the fellow during their fellowship and when sitting for the ABOG Subspecialty Certification Examinations. This *Guide* is the content list for the examinations given by the Divisions of the American Board of Obstetrics and Gynecology, Inc.

The Divisions regard the fellow as a graduate student with the implied responsibility for self-study and independent inquiry. The Program Director is responsible for providing adequate clinical experience, technical instruction, learning resources, study guidance, and periodic direct personal evaluation. The Program Director should review with the fellow an outline of study at least on an annual basis.

II. DEFINITION OF A MATERNAL-FETAL MEDICINE SUBSPECIALIST (MFM)

An MFM subspecialist is an obstetrician/gynecologist who, by virtue of additional education, cares for and/or provides consultation on women with complications of pregnancy and is expected to:

- Have advanced knowledge of obstetrical, medical, and surgical complications of pregnancy and their effects on the mother and fetus
- Be skilled in the areas of prenatal ultrasound and prenatal diagnosis
- Have clinical competence in MFM and be able to function as a consultant to obstetricians/gynecologists for women with complicated pregnancies
- Have advanced knowledge of newborn adaptation
- Be able to function effectively in the arena of basic and clinical research in MFM in order to advance the discipline and remain current in a rapidly changing field

At the completion of a program the fellow should be capable of managing complex maternal-fetal health care problems, scientific inquiry, and critical evaluation of the literature. Such a person must be able to function as a consultant to Obstetricians and other medical specialists.

III. OBJECTIVES

This *Guide* has enabling educational objectives that describe what the fellow should know and be able to perform by the end of their fellowship. These objectives principally refer to problem-solving skills needed to make a diagnosis and implement management programs. They also describe the skills the fellow must acquire to be able to accomplish the objectives.

IV. GENERAL CONSIDERATIONS

The practice of Obstetrics and Gynecology and MFM requires a commitment to professionalism as well as personal growth. In addition to practicing technical skills, physicians should cultivate the ability to expand and apply those skills. Knowledge of ethical principles, communication skills, and

the ability to acquire and continually update information are important components of professional development. The Accreditation Council on Graduate Medical Education (ACGME) identified six core competencies that should be incorporated into MFM subspecialty fellowship programs. The fellow should demonstrate competence at the level of a new MFM practitioner in the following:

1. *Patient Care*: Provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.
2. *Medical Knowledge*: Demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences relevant to MFM practice, and apply this knowledge to patient care.
3. *Practice-based Learning and Improvement*: Demonstrate the ability to investigate and evaluate patient care, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning.
4. *Interpersonal and Communication Skills*: Utilize outstanding interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and other health professionals.
5. *Professionalism*: Maintain a high level of commitment to the completion of professional responsibilities and an adherence to ethical principles.
6. *Systems-based Practice*: Cultivate an awareness of and responsiveness to the larger context and system of health care as well as the ability to call effectively on other resources in the system to provide optimal health care.

V. ENDOCRINOLOGY OF PREGNANCY

The fellow should acquire sufficient knowledge of endocrinology and metabolism in order to diagnose and appropriately manage endocrine diseases in the mother, fetus, and neonate.

A. Describe the following in relation to each hormone listed in Objective B below:

1. Alterations in insulin sensitivity during pregnancy
2. Maternal clinical effects and signs/changes during pregnancy
3. Placental transfer
4. Fetal effects
5. Function
6. Cellular mechanism
7. Hypofunction/Hyperfunction
 - a. Diagnosis: Clinical and laboratory
 - b. Effects of pregnancy on the disease state
 - c. Effects of the disease state on the mother, fetus, and neonate
 - d. Treatment
8. Fetal function
 - a. Gestational age at first function
 - b. Pattern of secretion during fetal life
 - c. Effect on development/maturation

B. Apply information in Objective A above to each of the following:

1. Hypothalamus
 - a. Gonadotropin releasing hormone (GnRH)
 - b. Somatostatin

- c. Thyrotropin releasing hormone (TRH)
- d. Dopamine
- e. Corticotropin releasing hormone (CRH)
- 2. Anterior pituitary
 - a. Luteinizing hormone (LH)
 - b. Follicle stimulating hormone (FSH)
 - c. Adrenal corticotropin hormone (ACTH)
 - d. Growth hormone (hGH)
 - e. Prolactin (hPR)
 - f. Thyroid stimulating hormone (TSH)
- 3. Posterior pituitary
 - a. Oxytocin
 - b. Vasopressin
- 4. Thyroid
 - a. Triiodothyronine (T3)
 - b. Thyroxine (T4)
 - c. Reverse triiodothyronine (RT3)
- 5. Parathyroid
 - a. Parathormone
 - b. Calcitonin
- 6. Pancreas
 - a. Insulin - Proinsulin; C-peptide
 - b. Glucagon
 - c. Somatomedin
- 7. Adrenal cortex
 - a. Glucocorticoids
 - b. Mineralocorticoids
 - c. Androgens
- 8. Adrenal Medulla
 - a. Epinephrine
 - b. Norepinephrine
- 9. Ovary
 - a. Estrogens
 - b. Progesterone
 - c. Relaxin
 - d. Androgens
- 10. Liver
 - a. Fibrinogen
 - b. Binding globulins (thyroid, cortisol, etc.)
- 11. Placenta and decidua
 - a. Human chorionic gonadotropin (hCG)
 - b. Human placental lactogen (hPL)
 - c. Estrogen
 - d. Progesterone
 - e. Gonadotropin releasing hormone
 - f. Prolactin
 - g. Prostaglandins-Thromboxane, Prostacyclin
 - h. 1,25 dihydroxycholecalciferol
 - i. Relaxin
 - j. Corticotrophin releasing hormone (CRH)
 - k. Fibronectin

12. Fetal tissues
 - a. Corticotropin releasing hormone
 - b. DHEA

VI. PHYSIOLOGY

The fellow should have sufficient knowledge of normal and abnormal physiology to manage the mother, fetus, and newborn at increased risk.

A. NUTRITIONAL CHANGES DURING PREGNANCY/LACTATION

1. Describe normal daily requirements
2. Describe the obligatory increases in gestational weight gain and recommended gestational weight gain based on maternal pregravid BMI and existing IOM guidelines
3. Counsel appropriate dietary intake for a metabolic disorder (e.g., diabetes, obesity, intestinal bypass, gastric banding, etc.).
4. Describe diagnosis and management of dietary deficiencies (e.g., folic acid, calcium, iron, vitamin D, etc.).
5. Counsel patients with special dietary practices (e.g., vegetarian, etc.).
6. Describe total parenteral nutrition during pregnancy.

B. FLUID AND ELECTROLYTE BALANCE DURING PREGNANCY

1. Describe normal distribution of basic body components in mother and fetus, including:
 - a. Volume and distribution of:
 - 1) Maternal total body water
 - 2) Maternal and fetal intracellular-extracellular water and exchange
 - 3) Amniotic fluid composition and exchange
 - b. Osmotic pressure determinants of:
 - 1) Maternal and amniotic fluid osmolar concentrations
 - 2) Other regulatory mechanisms for maintenance of normal acid-base balances in the mother and the fetus
2. List the effects of oxytocin on colloids, crystalloids, and free water (e.g., D5W or fluid and electrolyte balances).
3. Describe the expected changes in maternal blood volume during the first 6 weeks postpartum.
4. Describe how a multiple gestation affects the adaptive responses during and after pregnancy for items 1, 2, and 3 above.
5. Identify preexisting maternal conditions that may adversely affect adaptive responses during and after pregnancy for items 1, 2, and 3 above.

C. PULMONARY CHANGES DURING PREGNANCY

1. Describe changes in pulmonary physiology and pulmonary function tests in pregnancy.
2. Describe normal values for arterial blood gases during pregnancy.
3. Describe the unique features of managing mechanical ventilation during or after pregnancy.

D. NORMAL CARDIOVASCULAR FUNCTION DURING PREGNANCY

1. Describe normal cardiac function during pregnancy, including:
 - a. Auscultatory and hemodynamic changes
 - b. Detailed cardiac evaluation

- c. Invasive and non-invasive hemodynamic monitoring
 - d. Interpretation and expected results for maternal echocardiography in pregnancy
 - e. Influence of physiologic changes on diagnostic modalities
2. Describe the expected changes in maternal cardiac function during the first 6 weeks postpartum.
 3. Describe how a multiple gestation affects cardiovascular function during and after pregnancy.
 4. Identify preexisting maternal cardiac conditions, which may adversely affect cardiac function during and after pregnancy (e.g., mitral stenosis, aortic regurgitation, and right to left shunt).

E. BLOOD

1. Describe gestational changes in the normal constituents of blood, including:
 - a. White blood count, differential, hematocrit, hemoglobin, red blood count, red cell indices
 - b. Platelet count
 - c. Fibrinogen level
 - d. Prothrombin time
 - e. Partial thromboplastin time
 - f. Serum iron
 - g. Serum iron binding capacity
 - h. Hemoglobin electrophoresis
2. Demonstrate an understanding of normal coagulation and how this is altered by pregnancy.
3. Describe expected changes in serum albumin and total serum proteins concentrations during pregnancy.

F. GASTROINTESTINAL TRACT

1. Describe the pregnancy-associated changes in gastric acidity and gastrointestinal motility.
2. Describe the effects of sex hormones on gastrointestinal tract and liver function.
3. List the absorption and metabolism of iron, calcium, phosphorus, trace metals, and vitamins, carbohydrates, proteins, fats.
4. Discuss expected changes in biliary and gallbladder function.

G. RENAL FUNCTION

1. Describe the changes in renal function in pregnancy, including:
 - a. Glomerular filtration rate
 - b. Renal plasma flow
 - c. Ureteral function
 - d. Bladder function
2. Describe expected changes in renal function tests during pregnancy, including:
 - a. Twenty-four hour renal clearance tests
 - b. Urine electrolytes, protein, and glucose
 - c. Urine osmolality

H. UTERUS

1. Describe physical and biochemical changes in the cervix and uterus during pregnancy.
2. Describe the myometrial events involved in the initiation of parturition.
3. Describe normal labor, including:

- a. Uterine contractility
- b. Mechanisms controlling uterine contractility
- c. Mechanisms and expected effects of pharmacologic modulation of uterine contractility, including:
 - 1) Oxytocin
 - 2) Prostaglandin F_{2α}
 - 3) Prostaglandin E₂
 - 4) Methylergonovine
 - 5) Beta adrenergics
 - 6) Magnesium sulfate
 - 7) Oxytocin antagonists
 - 8) Progestins
4. Describe abnormal labor: Etiology, recognition of maternal and fetal effects.
5. Describe the factors influencing regulation of uterine blood flow, including:
 - a. Epidural anesthesia
 - b. Maternal positioning
 - c. Estrogens
 - d. Sympathomimetics

I. FETUS

1. Describe the fetal-placental circulation.
2. Demonstrate understanding of acid-base balance in the maternal intervillous and fetal compartments.
3. Describe normal fetal growth and development, including:
 - a. Cellular and humoral immunity
 - b. Hematopoietic system
 - c. Central nervous system
 - d. Pulmonary system
 - e. Genitourinary system
 - f. Cardiopulmonary system
4. Describe fetal adjustments to environmental changes, including:
 - a. Heart rate
 - b. Movement, including fetal breathing
 - c. Acid-base balance
 - d. Metabolism
 - e. Maternal obesity and undernutrition

J. PLACENTA

1. Describe the developmental anatomy, structure, and circulation through the placenta.
2. Describe the metabolic and endocrine functions of the placenta.
3. Describe the origin, composition, and regulation of amniotic fluid.
4. List mechanisms of transfer of nutrients, metabolic wastes, and pharmacologic agents:
 - a. Active transport
 - b. Facilitated diffusion
 - c. Simple diffusion
 - d. Pinocytosis
5. Describe other factors important in fetal and maternal respiratory gas exchange, including:
 - a. Gas tension and content
 - b. Oxygen capacity

- c. Diffusing capacity
- d. Relationship of maternal blood flow pattern with fetal blood flow
- e. Fetal oxygen dissociation curve
- f. Maternal oxygen dissociation curve
- g. Lipid or water solubility
- h. Ionic change
- i. Molecular size
- j. Concentration gradients

VII. BIOCHEMISTRY

The fellow should be able to discuss the principal biochemical pathways in maternal and fetal physiology. Describe or outline:

- A. Steroid synthesis and metabolism
- B. Prostaglandin synthesis and metabolism
- C. Maternal and fetal protein, lipid (e.g., lipogenesis, lipolysis, etc.) and carbohydrate (e.g., gluconeogenesis, glycogenolysis, etc.) metabolism
- D. Insulin signaling changes during pregnancy
- E. Placental hormone production and metabolism
- F. Production and destruction of bilirubin
- G. Fetal energy requirements for normal development (e.g., oxygen, glucose and other substrates)
- H. Production of fetal pulmonary surfactant
- I. Biochemistry of uterine contractions and action of common tocolytics

VIII. PHARMACOLOGY

The fellow should be able to analyze the action of the identified drug and its metabolism and excretion in the mother, placenta, breast milk, fetus, and neonate.

- A. List the effects of maternal physiologic adjustments on absorption, disposition, and metabolism of drugs, including:
 - 1. Effect of blood volume
 - 2. Gastrointestinal absorption
 - 3. Volume of distribution
 - 4. Renal excretion
 - 5. Protein binding
 - 6. Hepatic metabolism
- B. Describe the transfer of drugs across the placenta and into embryonic/fetal structures, including the:
 - 1. Movement of drugs into amniotic fluid and their penetration into the fetus
 - 2. Effects of physiochemical characteristics of drugs (lipid solubility, pKa, molecular weight, and protein binding)
 - 3. Effects of changes in maternal and fetal blood flow on the transfer of drugs to and from

the fetus

4. Effects of placental maturation and surface area on the transfer of drugs
5. Effects of placental disease on drug transfer
6. Metabolism of drugs by the placenta
7. Significance of other potential routes for drug transfer to and from the fetus (e.g., skin and urinary, gastrointestinal and respiratory tracts)
8. Effects of maternal disease such as hypertension or vascular disease on drug transfer

C. Identify fetal drug effects and factors affecting drug disposition in the fetus in each trimester.

D. Describe the effect of drugs in the newborn infant, such as:

1. Anti-seizure agents
2. Opioids
3. Anti-depressant agents

E. Outline the distribution, serum levels, levels in colostrum and breast milk, and metabolism of specific drug classes, such as:

1. Antibiotics
2. Antiviral agents
3. Analgesics and anesthetics
4. Cardiovascular drugs (e.g., antihypertensives, digitalis, beta mimetics)
5. Tranquilizers, barbiturates, antidepressants, and psychotropic drugs
6. Oral contraceptives and other hormones
7. Antineoplastic drugs
8. Anticonvulsants
9. Anticoagulants
10. Corticosteroids and other immunologic agents

IX. PATHOLOGY

The fellow should be able to describe the indications for evaluation and detail pathologic changes in the placenta, membranes, and umbilical cord. In instances of stillbirth or perinatal death, the fellow should interpret their significance in regard to diseases and abnormalities in the fetus, the mother, or both.

A. PLACENTA

1. Be able to diagnose and describe the importance of:
 - a. Abnormalities in size and shape
 - b. Premature separation or abruption
 - c. Placenta accreta
 - d. Inflammation
 - e. Infarction
 - f. Infection
 - g. Chorioangioma
 - h. Trophoblastic disease
 - i. Maturation
2. Describe the importance of placental evaluation in pregnancies with multiple fetuses.

B. CHORION AND AMNION

1. Diagnose and describe the importance of:
 - a. Meconium staining
 - b. Inflammation
 - c. Infection
 - d. Amnion nodosum
 - e. Amniotic band syndrome
2. Describe anatomic relationships with multiple fetuses and implications regarding zygosity.

C. UMBILICAL CORD

1. Diagnose and describe the importance of:
 - a. Abnormalities in cord insertion, including velamentous insertion and vasa previa
 - b. Single umbilical artery
 - c. True and false knots
 - d. Hematoma
 - e. Thrombosis
 - f. Infection and inflammation

D. STILLBIRTH/PERINATAL DEATH

1. List and order the diagnostic studies appropriate for evaluating a perinatal death.
2. Describe the clinicopathologic correlations of the following:
 - a. Developmental abnormalities due to:
 - 1) Aneuploidy
 - 2) Polygenic/multifactorial inheritance
 - 3) Mendelian defects
 - b. Generalized infections due to:
 - 1) Bacteria: Group B Streptococcus, Listeria, syphilis
 - 2) Viruses: herpes viruses, cytomegalovirus, rubella, parvovirus
 - 3) Protozoa: toxoplasmosis
 - c. Pulmonary disease due to:
 - 1) Hyaline membrane disease
 - 2) Bronchopulmonary dysplasia
 - 3) Pneumonitis: infections, meconium aspiration
 - 4) Pulmonary hypoplasia
 - d. Aberrant fetal growth due to:
 - 1) Fetal growth restriction associated with:
 - a) Maternal disease
 - b) Placental abnormalities
 - c) Intrinsic fetal abnormality
 - 2) Fetal macrosomia associated with:
 - a) Maternal diabetes mellitus
 - b) Prolonged gestation
 - e. Hydrops fetalis
 - 1) Immune and non-immune
 - f. Perinatal central nervous system abnormalities
 - 1) Hemorrhage: Intraventricular, subarachnoid, subdural
 - 2) Periventricular leukomalacia
 - 3) Infarction
 - 4) Hypoxic ischemic encephalopathy
 - 5) Infection and inflammation: Fetal inflammatory response
 - g. Necrotizing enterocolitis

X. GENETICS AND PRENATAL DIAGNOSIS

The fellow should have sufficient knowledge of basic human genetics and diagnostic techniques to provide genetic counseling for some of the commonly recognized disorders.

A. PATTERNS OF INHERITANCE

1. Describe Mendelian modes of inheritance, including:
 - a. Autosomal dominant
 - b. Autosomal recessive
 - c. Co-dominant
 - d. X-linked recessive
 - e. X-linked dominant
2. Describe non-Mendelian modes of inheritance, including:
 - a. Trinucleotide repeat disorders
 - b. Imprinting
 - c. Uniparental disomy
 - d. Mitochondrial inheritance
 - e. Germline mosaicism
 - f. Multifactorial and polygenic inheritance
3. Explain the importance of late manifestations, incomplete penetrance, variable expression, and genetic heterogeneity and gene-linkage in human disease.
4. Describe the Hardy-Weinberg Law and its applications.
5. Describe the significance of new mutations in humans.

B. CYTOGENETICS

1. Outline the principles of human cytogenetics, including:
 - a. Cell cycle
 - 1) Meiosis (and understand its biologic function)
 - 2) Mitosis
 - b. Preparation and staining human chromosomes, including banding and fluorescence in situ hybridization
 - c. Derivation and significance of X and Y chromatin
 - d. Normal karyotype
 - e. Chromosome nomenclature

C. CHROMOSOMAL ABNORMALITIES

1. Explain and interpret chromosome pathology, including:
 - a. Phenotypes associated with the common aneuploidies
 - 1) 21
 - 2) 18
 - 3) 13
 - b. Effects of deletions (e.g., Di George syndrome) Significance of translocations and translocation carriers, including the importance of empiric risk data
 - c. Significance of numeric and structural abnormalities of x-linked conditions (e.g., fragile X syndrome, monosomy x)
2. Describe the incidence and types of chromosome anomalies in spontaneous and recurrent abortions.
3. Describe the evaluation, management, and counseling of couples with recurrent

abortions.

4. Describe recurrence risks, prognosis, and alternative treatments for families with history of chromosome anomalies (donor egg/sperm; preimplantation genetic diagnosis).

D. PRENATAL DIAGNOSIS

1. Discuss amniocentesis, chorionic villus sampling, and cordocentesis, including:
 - a. Techniques
 - b. Maternal and fetal risks
 - c. Limitation of the techniques
2. Discuss use of fetal cells in maternal blood and free fetal DNA and microarray for prenatal diagnosis, including:
 - a. Advantages, disadvantages, and limitations
 - b. Disorders amenable to application of these techniques
3. Describe indications for invasive prenatal diagnostic tests, including:
 - a. Maternal age
 - b. Paternal age
 - c. Previous aneuploidy
 - d. Chromosomal abnormality in a parent
 - e. Fetal structural abnormality
 - f. Pregnancies at risk for X-linked hereditary disease (e.g. fragile x)
 - g. Diagnosis of neural tube defect
 - h. Pregnancies at risk for detectable chromosomal or biochemical disorders
4. Describe the use of molecular genetic analysis techniques for mutation detection, including:
 - a. Southern blot analysis
 - b. Polymerase chain reaction
 - c. Restriction fragment length polymorphism analysis
 - d. Linkage analysis
 - e. Fluorescent in situ hybridization
5. Discuss ethical issues in prenatal diagnosis, including gender selection.
6. Describe capabilities and limitations of ultrasonography in prenatal diagnosis, including:
 - a. Techniques
 - 1) First trimester chromosome anomalies
 - 2) Second trimester chromosome anomalies
 - 3) Third trimester
 - 4) Anatomic targeted examination
 - 5) Fetal cardiac anomaly detection
 - 6) Use of color Doppler
 - 7) Use of 3D ultrasound
 - 8) Cervical and placental evaluation
 - a) Endovaginal technique
 - b. Assessment of bioeffects and safety
7. Describe capabilities and limitations of magnetic resonance imaging in prenatal diagnosis, including advantages and disadvantages relative to ultrasound.
8. Describe fetal blood sampling and fetal surgery:
 - a. Techniques
 - b. Assessment of immediate and long-term hazards of the procedure
 - c. Disorders amenable to diagnostic procedures
 - d. Disorders amenable to surgical treatment
 - e. Indications
9. Describe the technique and expected efficacy of preimplantation genetic diagnosis.

E. SCREENING

1. Describe the impact of and prerequisites for genetic screening programs.
2. Describe the components used in first trimester screening and second trimester maternal multiple serum marker screening for fetal chromosome anomalies, including expected sensitivity and false positive rates.
3. Describe available techniques for screening and counseling couples at risk for:
 - a. Neural tube defects
 - b. Chromosomal Aneuploidy
 - c. Cystic fibrosis
 - d. Canavan disease
 - e. Tay-Sachs disease
 - f. Familial dysautonomia
 - g. Hemoglobinopathies
 - h. Fragile X syndrome
 - i. Spinal muscular atrophy
 - j. Sickle cell anemia
4. Describe the genetic screening for gamete donors.

F. COUNSELING

1. Describe the components of preconceptional counseling.
2. List the elements of genetic counseling, including knowledge of the diagnosis, mode of inheritance, risk of recurrence, and prognosis.
3. Describe the principles of genetic counseling.
4. Describe the management of maternal phenylketonuria.
5. Record and interpret pedigree data.

XI. EMBRYOLOGY AND TERATOLOGY

The fellow should be able to counsel persons exposed to teratogenic agents.

A. Describe normal embryology.

B. Outline the general principles of teratology:

1. Importance of the genotype of the fetus and the mother
2. Relationship between the teratogenic effect and developmental stage at the time of exposure (e.g., critical periods for organogenesis)
 - a. Preimplantation period
 - b. Embryonic period
 - c. Fetal period
3. Dose-response relationship of teratogenic agents
4. Species specificity

C. Describe the criteria for proof of human teratogenicity.

D. Describe the mechanisms of teratogenesis leading to abnormal embryogenesis:

1. Know the distinction between embryopathy and fetopathy
2. Describe the risks of maternal/paternal teratogenic exposures

E. List the effects on the fetus and newborn of suspected teratogenic agents, such as:

1. Drugs and medications
 - a. Illegal drugs
 - b. Anticonvulsants
 - c. Anticoagulants
 - d. Antidepressants/antipsychotics/medications for mood disorders
 - e. Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers
 - f. Retinoids
 - g. Hormones
 - h. Antineoplastic agents
 - i. Antimicrobials, antifungals, and antivirals
2. Herbal products
3. Infections: Viral, bacterial, and parasitic
 - a. Evaluation of mother and newborn with exposure
 - b. Effects on fetus at various stages of gestation
 - c. Prenatal diagnosis
 - d. Risk of morbidity and mortality
 - e. Antepartum prevention and treatment
4. Vaccinations
5. Radiation and other physical agents
 - a. Investigate and counsel a pregnant woman or her spouse exposed to irradiation or agents
 - b. Explain the effects of dose, dose rate, stage of gestation, and specific target organ at risk produced by:
 - 1) External ionizing radiation: Radiographic, angiographic, fluoroscopic, and computed tomographic
 - 2) Nuclear medicine studies and radioactive isotopes
 - 3) Nuclear natural disaster or attack
 - 4) Biologic or chemical weapons
6. High-intensity ultrasonography
7. Maternal conditions
 - a. Nutritional deficiencies and excesses
 - b. Diabetes mellitus
 - c. Phenylketonuria
8. Environmental agents
 - a. Alcohol
 - b. Methylmercury
 - c. Lead
 - d. Pesticides
 - e. Tobacco
 - f. Caffeine
 - g. Hyperthermia

F. Review critically retrospective and prospective studies of suspected teratogenic agents.

G. Describe the counseling in cases of teratogen exposure:

1. Preconception counseling
2. Antepartum exposure
3. Paternal exposure

XII. MEDICAL AND SURGICAL COMPLICATIONS

The fellow should be able to diagnose and manage medical and surgical complications of pregnancy that may affect the mother, fetus, and neonate.

A. RENAL DISEASE

1. Describe the utilization of the following laboratory tests:
 - a. Urinalysis, urine osmolality
 - b. Plasma BUN, creatinine, uric acid
 - c. Endogenous creatinine clearance
 - d. Timed urinary protein collection
 - e. IVP, renal scan, CT scan, ultrasound, MRI
 - f. Renal biopsy
2. Describe the diagnosis and management for women with:
 - a. Diabetic nephropathy
 - b. Glomerular and interstitial nephritis (e.g., lupus nephritis)
 - c. Acute and chronic pyelonephritis
 - d. Nephrotic syndrome
 - e. Chronic undifferentiated renal disease (arteriolar nephrosclerosis)
 - f. Renal transplantation and dialysis
 - g. Acute tubular necrosis and renal cortical necrosis
 - h. Acute and chronic renal failure

B. CARDIOVASCULAR DISEASE

1. Interpret tests to diagnose cardiac abnormalities and to assess cardiac reserve during pregnancy in disease states:
 - a. Assign functional classification of heart disease based upon New York Heart Association classification
 - b. Order and make electrocardiographic diagnoses of arrhythmias
 - c. Order and interpret chest x-rays
 - d. Order and interpret echocardiography, in consultation with other specialists
 - e. Interpret pulmonary function tests (e.g., vital capacity, etc.)
 - f. Order and interpret cardiac catheterizations, in consultation with other specialists
2. Describe the pathophysiology, diagnosis, and plan of management for:
 - a. Congenital heart disease:
 - 1) Atrial septal defects
 - 2) Patent ductus arteriosus
 - 3) Ventricular septal defect
 - 4) Pulmonary stenosis
 - 5) Coarctation of aorta
 - 6) Tetralogy of Fallot
 - 7) Eisenmenger syndrome
 - 8) Aortic stenosis
 - 9) Hypertrophic sub-aortic stenosis
 - 10) Marfan syndrome
 - b. Pregnancy with cardiac valve prostheses
 - c. Primary pulmonary hypertension
 - d. Peripartum cardiomyopathy
 - e. Cardiac arrhythmias (e.g., supraventricular tachycardia, atrial fibrillation, ectopic beats, etc.)

- f. Mitral valve prolapse
 - g. Hypertensive disorders
 - h. Coronary artery disease
 - i. Heart failure
 - j. Cardiac transplantation
3. Treat with the following drugs and recognize the side effects of:
- a. Anti-arrhythmic agents
 - b. Diuretics
 - c. Antibiotic therapy for prevention of bacterial endocarditis and recurrence of rheumatic fever
 - d. Anticoagulants
 - e. Vasoactive drugs, including inotropic agents, including digitalis preparations, and antihypertensive agents, including calcium channel blockers, beta-blockers, etc.

C. HEMATOLOGIC DISORDERS

1. Diagnose the following diseases and formulate a plan of management for:
- a. Anemias (e.g., iron, folate deficiency)
 - b. Hemoglobinopathies
 - c. Thrombocytopenias
 - d. Congenital and acquired coagulation defects
 - e. Thrombophilias and thromboembolism
 - f. Leukemias and lymphomas
2. Describe the appropriate use and the risk of:
- a. Whole blood
 - b. Fresh frozen plasma
 - c. Cryoprecipitate
 - d. Platelets
 - e. Packed red cells
 - f. Recombinant factors
3. Describe a plan for long-term anticoagulation therapy in pregnancy and puerperium
- a. Anticoagulation
 - 1) Prophylactic
 - 2) Therapeutic
 - b. Anticoagulant agents
 - 1) Vitamin K antagonists, such as Coumadin
 - 2) Factor Xa inhibitors, such as:
 - a) Unfractionated heparin
 - b) Low molecular weight heparin
 - 3) Direct thrombin inhibitors
 - c. Indications for use
 - d. Risk of complications

D. LIVER DISEASE

1. Diagnose and describe management of common hepatic diseases in pregnancy:
- a. Gall bladder and biliary tract diseases
 - b. Hepatitis
 - 1) Infectious
 - 2) Autoimmune
 - c. Acute fatty degeneration, acute liver failure secondary to the above states, drug ingestion, or steatosis

- d. Cirrhosis
 - e. Changes secondary to preeclampsia, eclampsia
 - f. Hyperemesis gravidarum
 - g. Cholestasis
2. Describe a plan of management for:
- a. Hepatic rupture
 - b. Liver transplantation

E. GASTROINTESTINAL DISORDERS

1. Diagnose and describe the management of common gastrointestinal disorders in pregnancy:
- a. Peptic ulcer
 - b. Inflammatory bowel disease
 - c. Intestinal obstruction
 - d. Pancreatitis
 - e. Appendicitis
 - f. Prior intestinal surgery (e.g., gastric or intestinal bypass, stomas)
 - g. Abdominal trauma with possible viscus rupture and hemoperitoneum

F. NEUROPSYCHIATRIC DISEASE

1. Formulate a plan of management for the following:
- a. Cerebral thrombosis, including cortical venous thrombosis
 - b. Cerebral hemorrhage (subarachnoid hemorrhage) secondary to a
 - 1) Ruptured aneurysm
 - 2) Arteriovenous malformation
 - c. Myasthenia gravis
 - d. Multiple sclerosis
 - e. Myotonic dystrophy
 - f. Meningitis
 - g. Guillain-Barre syndrome
 - h. Spinal cord lesions
 - i. Neurologic tumors
 - j. Shunts for hydrocephaly
 - k. Migraine headaches
 - l. Pseudotumor cerebri
 - m. Chorea gravidarum
 - n. Porphyria
 - o. Psychiatric diseases: Major depression, bipolar disease, schizoaffective disorder, schizophrenia, eating disorders, and postpartum depression
2. Counsel and treat women with epilepsy.

G. PULMONARY DISEASE

1. Diagnose and formulate a plan of management for:
- a. Asthma
 - b. Pulmonary embolism
 - c. Tuberculosis
 - d. Infections (viral, bacterial, fungal)
 - e. Adult respiratory distress syndrome
 - f. Aspiration pneumonitis
 - g. Restrictive disorders, including kyphosis, scoliosis, and connective tissue

- diseases
 - h. Pneumothorax
 - i. Pulmonary hypertension
 - j. Respiratory failure
2. Describe a plan of management for:
 - a. Cystic fibrosis
 - b. Pulmonary transplantation
 3. Describe the use and interpretation of pulmonary function tests in the management of any of the aforementioned diseases.

H. AUTOIMMUNE DISEASE

1. Describe a plan of management for:
 - a. Rheumatoid arthritis
 - b. Systemic lupus erythematosus
 - c. Scleroderma
 - d. Dermatomyositis
 - e. Sjögren's
2. Describe the diagnosis and management of:
 - a. Antiphospholipid antibody syndrome
 - b. Idiopathic thrombocytopenic purpura

I. GYNECOLOGIC DISEASE

1. Describe a plan of management for:
 - a. Leiomyomas
 - b. Gynecologic cancers
 - c. Uterine prolapse
 - d. Cystocele
 - e. Vaginitis
 - f. Uterine incarceration
2. Describe the evaluation, diagnosis, and treatment of sexually transmitted diseases.

J. NEOPLASMS

1. Describe the management of neoplasms in pregnant women and/or their fetuses, including:
 - a. Lymphoma
 - b. Leukemia
 - c. Breast malignancy
 - d. Cervical carcinoma
 - e. Melanoma
 - f. Thyroid cancer
 - g. Colon cancer
 - h. Trophoblastic disease
 - i. Metastatic cancer
 - j. Metastatic cancers to fetus and placenta
 - k. Fetal tumors
2. Describe the use and risks of chemotherapeutic agents in pregnancy.

K. ENDOCRINE DISORDERS

1. Diabetes Mellitus

- a. Diagnose gestational and pre-gestational diabetes during pregnancy.
 - b. Describe the maternal and infant management and consequences of diabetes:
 - 1) Effects of pregnancy on the diabetic mother
 - 2) Effects of diabetes on the maternal, fetal and neonatal organ systems
 - c. Manage medical problems of the diabetic woman.
 - d. Describe the mechanisms responsible for the development of hypoglycemia, hyperglycemia, and ketoacidosis.
 - e. Describe how to avoid complications by the appropriate use of:
 - 1) Diet
 - 2) Insulin
 - 3) Oral Hypoglycemic agents
2. Thyroid Disorders
- a. Diagnose and manage:
 - 1) Hyperthyroidism due to a variety of causes, including Graves Disease
 - 2) Acute thyrotoxicosis
 - 3) Hypothyroidism: Overt and subclinical due to a variety of causes, including Hashimoto's Disease
 - 4) Diagnose and refer thyroid masses
3. Adrenal
- a. Diagnose and manage:
 - 1) Congenital adrenal hyperplasia
 - 2) Addison's Disease
 - 3) Cushing's Disease
 - 4) Hyperaldosteronism
 - b. Describe the diagnosis and surgical management of pheochromocytoma.
4. Pituitary
- a. Describe the diagnosis and management of:
 - 1) Adenomas
 - 2) Hyperprolactinemia
 - 3) Diabetes insipidus
 - 4) Insufficiency

L. SUBSTANCE ABUSE

1. Describe screening and identification of substance abuse.
2. Describe maternal and infant risks, management and consequences of substance abuse due to:
 - a. Alcohol
 - b. Nicotine
 - c. Narcotics
 - d. Prescription drugs, including barbiturates and phenothiazines
 - e. Illicit drugs, including cocaine, methamphetamines, and marijuana among others

M. DERMATOLOGIC DISORDERS

1. Describe the normal cutaneous changes of pigmentation and hair in pregnancy.
2. Recognize and diagnose:
 - a. Common dermatological disorders
 - b. Dermatological disorders unique to pregnancy
 - 1) Pruritic urticarial papules and plaques of pregnancy (PUPPP)
 - 2) Gestational pemphigoid
 - 3) Impetigo herpetiformis

N. NON-OBSTETRIC SURGERY

1. Describe the complications, risks of surgery, and management in the:
 - a. First trimester
 - b. Second trimester
 - c. Third trimester
2. Describe anesthetic concerns for non-obstetric surgery.
3. Describe fetal monitoring concerns in:
 - a. Burn patients
 - b. Trauma patients
 - c. Hypothermic cases
 - d. Cardiopulmonary bypass cases
 - e. Laparoscopic cases

XIII. INFECTIOUS DISEASES

The fellow should demonstrate the ability to diagnose and treat infectious diseases in the mother and fetus and to demonstrate knowledge of the principles of diagnosis and treatment in the neonate.

A. EPIDEMIOLOGY

1. Describe the incidence/prevalence of infectious diseases in pregnancy and in the neonatal period.
2. Describe the impact of these diseases on maternal and child health.

B. PATHOPHYSIOLOGY, DIAGNOSIS, AND TREATMENT

1. Describe the altered host factors in pregnant women, the fetus, and newborn predisposing them to infectious diseases.
2. Describe the genital tract flora during pregnancy.
3. Describe sources and possible influences leading to colonization and infection of the fetus and neonate with:
 - a. Bacteria
 - b. Viruses
 - c. Parasites and protozoa
4. Describe the pathophysiology, organisms, diagnostic evaluation, approach to treatment, and maternal/fetal/neonatal health consequences for the following infections. (include specific counseling about intrapartum management, mode of delivery and breastfeeding as appropriate):
 - a. Septic abortion
 - b. Chorioamnionitis
 - c. Endomyometritis
 - d. Urinary tract infections
 - e. Pneumonia
 - f. Surgical and nosocomial infection
 - g. Pneumonia
 - h. Mastitis
 - i. Listeria
 - j. Tuberculosis
 - k. Hepatitis A, B, C

- l. CMV
- m. HSV
- n. Toxoplasmosis
- o. Varicella
- p. Parvovirus
- q. Syphilis
- r. HIV

C. PROPHYLAXIS

1. Counsel patients regarding the following scenarios:
 - a. Immunizations in pregnancy and the puerperium
 - b. International travel and prophylaxis of various infections in developing countries
 - c. Exposure to emerging infections and bioterrorism
2. Explain the consequences of a maternal-fetal perinatal infection such as pre-labor chorioamnionitis for a subsequent pregnancy.
3. Describe prophylaxis strategies for:
 - a. sexually transmitted infections in pregnancy and/or at delivery
 - b. neonatal group B streptococcal sepsis.
4. Describe management when a susceptible pregnant woman or a newborn is exposed to common bacterial and viral pathogens.

XIV. OBSTETRICAL COMPLICATIONS

The fellow should be able to diagnose and outline a plan of management for obstetrical complications, including acute peripartum emergencies and obstetric critical care.

A. BLEEDING DURING PREGNANCY

1. Diagnose and manage:
 - a. Abnormal placental implantation or development (e.g., placenta previa, abruption, placenta accreta, vasa previa, ectopic pregnancy, and trophoblastic tumors)
 - b. Trauma to the genital tract
 - c. Uterine atony
 - d. Coagulation defects
 - e. Fetomaternal bleeding

B. HYPERTENSION IN PREGNANCY

1. Describe, diagnose, and manage hypertensive disorders of pregnancy:
 - a. Specific causes of hypertension
 - b. Risk of assessment and possible approaches to prevention
 - c. Pathologic changes in mother, fetus, and newborn
 - d. Use and mechanism of action of anticonvulsants and antihypertensive agents
 - e. Disease complications and treatment
 - f. Techniques to monitor mother and fetus
 - g. Prognosis for subsequent pregnancies

C. PREMATURE RUPTURE OF MEMBRANES

1. Describe the:
 - a. Pathophysiology

- b. Management
 - c. Methods of diagnosis
 - d. Methods of evaluating pulmonary maturity
2. Describe the use of glucocorticoids, antibiotics, and tocolytic agents.
 3. Describe problems of infection and effects on mother, fetus, and newborn.
 4. Describe abnormalities of maternal local and systemic inflammatory response.
 5. Describe prognosis for subsequent pregnancies.
 6. Describe risk assessment and possible approaches to prevention.

D. PRETERM LABOR

1. Describe, diagnose, and manage premature labor and understand the:
 - a. Etiology
 - b. Use and complications of therapeutic modalities, including tocolytics and glucocorticoids
 - c. Maternal, fetal, and neonatal complications
 - d. Methods for delivery, with attention to fetal weight and lie
 - e. Risk assessment and possible approaches to prevention
2. Describe the use of maternal transport.
3. Describe abnormalities of maternal local and systemic inflammatory response.

E. MULTIPLE GESTATION

1. Describe the:
 - a. Diagnosis
 - b. Antepartum evaluation and management
 - c. Methods of delivery
 - d. Complications and management of:
 - 1) Twin-twin transfusion syndrome
 - 2) TRAP sequence
 - 3) Discordance
 - 4) Monoamniotic twins
 - 5) Retained fetal demise
2. Describe the indications, techniques, and complications of fetal reduction.
3. Describe the management of higher order multiple gestations.

F. CRITICAL CARE

1. Diagnose and provide critical care management during pregnancy and peripartum for:
 - a. Acute blood loss and hemorrhagic shock
 - b. Adult respiratory distress syndrome
 - c. Amniotic fluid embolism
 - d. Cardiac arrest
 - e. Congestive heart failure and pulmonary edema
 - f. Eclampsia
 - g. Hypertensive crisis and severe pre-eclampsia
 - h. Trauma
 - i. Myocardial infarction
 - j. Peripartum cardiomyopathy
 - k. Pulmonary embolism
 - l. Respiratory failure
 - m. Septic shock
 - n. Diabetic ketoacidosis and hyperglycemic hyperosmolar coma

- o. Acute thyrotoxicosis
- 2. Describe the indications for and complications of invasive hemodynamic monitoring.
- 3. Outline a plan of management of a critically-ill patient with:
 - a. Arterial line
 - b. Central venous pressure catheter monitoring
 - c. Pulmonary artery catheter monitoring
 - d. Mechanical ventilation
- 4. Counsel women who have survived a critical care event about prognosis in this pregnancy and risks of recurrence with future pregnancies.

G. FETAL GROWTH RESTRICTION

- 1. Describe the:
 - a. Roles of maternal, placental, and fetal factors in the etiologies
 - b. Clinical, biochemical, and biophysical screening and diagnostic techniques
 - c. Criteria for monitoring fetal growth and well being
 - d. Effects on fetal and newborn prognosis (immediate and remote)
 - e. Method and timing of delivery
- 2. Counsel a patient on the risks of recurrence with future pregnancies.

H. MATERNAL UROGENITAL TRACT MALFORMATIONS

- 1. Describe the embryology of the urogenital tract.
- 2. Describe the etiology of specific malformations:
 - a. Diagnosis
 - b. Implications for pregnancy
 - c. Treatment

I. PROLONGED GESTATION

- 1. Describe the:
 - a. Risks to the fetus
 - b. Methods to monitor the fetus
 - c. Indications and methods for delivery
- 2. List neonatal complications of prolonged pregnancy.

J. FETAL DEATH, STILLBIRTH AND RECURRENT FETAL LOSS

- 1. Describe the:
 - a. Etiology of recurrent fetal loss
 - b. Diagnostic evaluation of recurrent fetal loss
 - c. Evaluation of an unexplained stillbirth
- 2. Outline appropriate management, including methods of termination.
- 3. Counsel a couple about prognosis for subsequent pregnancies.
- 4. Describe management of the grief process.

K. FETAL HYDROPS

- 1. Identify and describe the management of:
 - a. Non-immune hydrops
 - 1) Etiology
 - 2) Diagnosis
 - 3) Management
 - b. Immune hydrops

- 1) Antigen-antibody systems
 - 2) Pathophysiology
 - 3) Management
2. Describe the prevention of maternal alloimmunization.
 3. Describe the timing and mode of delivery in affected cases.

L. ABNORMALITIES OF LABOR

1. Describe the:
 - a. Anatomy of the pelvis
 - b. Types of pelvic architecture and associated complications of labor
2. Outline the diagnosis and management of dystocia.
3. List the indications for and complications of labor induction and augmentation agents.
4. Describe the indications, techniques, and complications of forceps and vacuum deliveries.
5. Describe the indications, techniques, and complications of cesarean delivery.
6. Describe the indications, techniques, and complications of cesarean hysterectomy.
7. Describe the management of pregnancies subsequent to previous cesarean delivery.
8. Outline the management of traumatic complications of labor.
9. Describe the medical and surgical management of intrapartum hemorrhage.

M. FLUID AND ELECTROLYTE DISORDERS

1. Diagnose and manage:
 - a. Volume deficits and excesses
 - b. Acid-base derangements
2. Describe the prevention and management of intrapartum hyponatremia.

N. ABNORMALITIES OF AMNIOTIC FLUID VOLUME

1. Diagnose and manage:
 - a. Hydramnios
 - 1) Etiologies
 - 2) Diagnostic criteria
 - 3) Complications
 - 4) Management
 - b. Oligohydramnios
 - 1) Etiologies
 - 2) Diagnostic criteria
 - 3) Complications
 - 4) Management

XV. ANALGESIA AND ANESTHESIA

The fellow should be able to understand the effects of analgesics and anesthetics employed during labor and delivery and to manage the complications.

A. SYSTEMIC ANALGESIA AND SEDATION

1. Describe the actions and maternal and fetal side effects of:
 - a. Opioids and other analgesics
 - b. Psychotropic agents
 - c. Barbiturates
 - d. Other sedatives

- e. Narcotic antagonists

B. GENERAL ANESTHESIA

1. Describe the actions of:
 - a. Nitrous oxide
 - b. Barbiturates, including thiopental
 - c. Halogenated agents
 - 1) Halothane
 - 2) Methoxyflurane
 - 3) Enflurane
 - d. Other agents
 - 1) Atropine
 - 2) Succinylcholine and other paralyzing agents
 - 3) Propofol

C. REGIONAL ANALGESIA

1. Describe the:
 - a. Pain pathway of labor and the sensory and motor innervation of the thorax, abdomen, and genital tract
 - b. Actions, pharmacology, and metabolism of local anesthetic agents
 - c. Indications, contraindications, and complications of
 - 1) Epidural analgesia
 - 2) Spinal analgesia
 - 3) Combined spinal epidural analgesia
 - 4) Paracervical block analgesia
 - 5) Pudendal nerve block analgesia
 - 6) Local anesthesia

D. ANESTHETIC COMPLICATIONS

1. Diagnose and manage in collaboration with a specialist:
 - a. Cardiac arrest
 - b. Respiratory arrest
 - c. Aspiration pneumonitis
 - d. Reactions to anesthetic agents
 - 1) Hypotension
 - 2) High spinal or total spinal
 - 3) Convulsions
 - 4) Neuropathy
 - 5) Headaches
 - e. Complications of intubation
 - f. Hyperthermia
2. Describe complications of opioid antagonists.
3. Describe the obstetric management of women with spinal cord injury: Autonomic dysreflexia.

E. ANESTHETIC MANAGEMENT OF MEDICAL AND OBSTETRICAL COMPLICATIONS

1. Describe the anesthetic management of:
 - a. Hypertensive diseases
 - b. Cardiac diseases

- c. Neurologic diseases
 - d. Bleeding disorders, including anticoagulation
 - e. Respiratory diseases
 - f. Breech deliveries, operative vaginal deliveries, cesarean deliveries, and multi-fetal gestations
2. Describe the etiology and management of intrapartum fever associated with epidural analgesia.
 3. Describe advantages and disadvantages of general anesthesia for cesarean delivery.

XVI. NEONATOLOGY

- A. Describe immediate care of the baby in the delivery room.
- B. Describe neonatal adaptation.
- C. Describe clinical evaluation of the newborn, including assessment of gestational age.
- D. Describe resuscitation of the newborn, including:
 1. Intubation and ventilation
 2. Drug use
 3. Cardiac massage
 4. Volume replacement
 5. Temperature control
 6. Interpretation and management of acid-base and blood gas status
 7. Ex-utero intrapartum treatment (EXIT) procedure
- E. Describe the etiology, management, sequelae, and, if appropriate, the prevention of:
 1. Respiratory disease, including meconium aspiration
 2. Persistent fetal circulation
 3. Hyperbilirubinemia
 4. Infection
 - a. Neonatal sepsis
 - b. Pneumonia
 5. Hypoxic ischemic encephalopathy
 6. Periventricular leukomalacia
 7. Seizures
 8. Metabolic abnormalities, including hypoglycemia and hypocalcaemia
 9. Hemorrhagic disorders
 10. Hypothermia
 11. Heart disease
 12. Intracranial hemorrhage
 13. Necrotizing enterocolitis
 14. Significant anomalies (e.g., ambiguous genitalia, abdominal wall, central nervous system, and gastrointestinal defects)
 15. Alloimmune thrombocytopenia
 16. Hydrops
- F. Describe developmental problems of the newborn and child with regard to:
 1. Very low birth weight infants

2. Low birth weight infants
3. Small for gestational age infants

G. Describe the use of surfactant therapy.

H. Describe neonatal critical care management involving:

1. Mechanical ventilation techniques
2. Extracorporeal membrane oxygenation

I. Describe the indications for, complications of, and success rates of neonatal surgery for common congenital anomalies.

XVII. PROCEDURES

A. Demonstrate a base of knowledge including, indications, contraindications, risks and principles, and experience sufficient to perform the following antepartum procedures independently:

1. Amniocentesis: 2nd and 3rd trimester
2. Amnioreduction
3. Maternal cardiopulmonary resuscitation
4. Transvaginal cervical cerclage
5. Fetal assessment
 - a. Non-stress test
 - b. Contraction stress test
 - c. Biophysical profile
 - d. Vibroacoustic stimulation test
6. Ultrasound examination
 - a. First, second, and third trimester
 - b. Targeted anatomic fetal evaluation
 - c. Cardiac evaluation including color Doppler
 - d. Doppler velocimetry
 - 1) Fetal umbilical artery
 - 2) Fetal middle cerebral artery
 - e. Cervical and placental evaluation
 - f. 3D and 4D ultrasound
7. External cephalic version of abnormal lie

B. Demonstrate a base of knowledge, including indications, contraindications, risks, and principles, and experience sufficient to perform the following intrapartum procedures independently:

1. Complicated cesarean delivery
2. Cesarean hysterectomy
3. Control of hemorrhage
 - a. Medical
 - b. Surgical
4. Delivery of multiple gestations
 - a. Management of the nonvertex, second twin
5. Version of second twin
 - a. Internal
 - b. External

C. Demonstrate an understanding of the indications, contraindications, risks, and principles for the following procedures:

1. Chorionic villus sampling
2. Cordocentesis
 - a. Fetal transfusion
3. Critical care management
 - a. Invasive hemodynamic monitoring
 - b. Ventilator management
4. Fetal reduction and selective termination procedures
5. Dilation and evacuation for second trimester fetal death or lethal anomalies
6. MRI for obstetric and fetal indications
7. Intrauterine fetal therapy
 - a. Placement of thoracic shunt
 - b. Placement of urinary catheter
 - c. Laser photocoagulation for the treatment of twin-twin transfusion syndrome

D. Fetal Surgery

1. Some programs may give special training in complex fetal surgery for various conditions. All fellows should be able to explain evaluation and referral of patients to fetal surgery specialists.

XVIII. FAMILY PLANNING

The fellow should demonstrate knowledge of the different methods of family planning, including the risks and benefits, and provide comprehensive and accurate contraceptive counseling tailored to a woman's specific medical status and reproductive needs.

A. Describe the mechanisms of action, efficacy in prevention of pregnancy, and complications of:

1. Hormonal contraceptives: Oral, injectable, transdermal patches, vaginal rings, and implants
2. Intrauterine devices
3. Barrier devices
4. Chemical spermicidal products
5. Natural family planning methods
6. Sterilization procedures, efficacy, and complications

B. Describe advantages and disadvantages of each type of family planning method in women with special problems, including:

1. Anemia, including sickle cell disease and hemoglobinopathies
2. Hypertension
3. Neurologic disorders: migraine headaches, multiple sclerosis, and seizures
4. Diabetes mellitus
5. Liver disease
6. Gynecologic abnormalities: Dysplasia, pelvic prolapse, myomas, and pelvic infections
7. Obesity and malnutrition
8. Urinary tract problems
9. Acquired and inherited thrombophilias

10. Bleeding disorders
11. Deep venous thrombosis and pulmonary embolism
12. Malignancies
13. Cardiac disease
14. HIV infection

XIX. EPIDEMIOLOGY, STATISTICS, EXPERIMENTAL DESIGN, & EVIDENCE-BASED MEDICINE

The fellow should demonstrate sufficient knowledge of epidemiology and statistical methods to design and interpret research.

A. Describe and interpret principles of epidemiology with regard to:

1. Descriptive epidemiology, including such concepts as disease incidence/prevalence and population attributable risk
2. Associations between disease and factors, including:
 - a. Criteria for judging causality
 - b. Quantitative assessment: Relative risk, odds ratio, attributable risk, number needed to screen/treat/harm
3. Characteristics of a screening test, including:
 - a. Criteria for establishing a screening program
 - b. Quantitative assessments: Sensitivity/specificity, positive and negative predictive value, likelihood ratios, and receiver-operating characteristic curve
4. Study design, including:
 - a. Experimental: Randomized clinical trials
 - b. Observational: Prospective cohort, retrospective cohort, case-control
 - c. Cost-benefit and cost-effectiveness analysis
 - d. Decision analysis
 - e. Systematic review and meta-analysis
5. Appropriate conduct of a study, including:
 - a. Calculation of power
 - b. Calculation of sample size
 - c. Case selection
 - d. Control selection
 - e. Randomization techniques
 - f. Human subject rights: Informed consent in pregnancy
 - g. Care and use of animals
 - h. Avoidance of and types of bias
 - i. Avoidance of and accounting for confounding variables
 - j. External validity

B. Describe and explain the use of:

1. Descriptive statistics
 - a. Measures of central tendency
 - b. Measures of dispersion
2. Hypothesis testing
 - a. P-values and confidence intervals
 - b. Types of non-parametric testing
 - c. Types of parametric testing
 - d. Multivariable techniques

C. Demonstrate knowledge of the general principles for ethical conduct of research. The fellow must understand and incorporate the following guidelines into everyday practice:

1. Scientific Integrity
2. Responsible data acquisition and management
3. Responsible authorship and publication
4. Responsible peer review
5. Proper mentor-trainee relationship
6. Responsible collaborative research
7. Protection of human and animal subjects
8. Conflict of interest and commitment

XX. THESIS REQUIREMENTS

A thesis is required by the Division of Maternal-Fetal Medicine. For a list of requirements, refer to the *Bulletin for Subspecialty Certification* on the ABOG website.