The chart shows the percentage distribution of questions on the Neonatal Neuro-Intensive Care exam across the major content categories covered on the examination.
EXAM OUTLINE

Areas of knowledge to be tested on the Neonatal Neuro-Intensive Care examination are listed in the following outline. This list is not intended as an all-inclusive review. It is provided only to help candidates evaluate their own practice.

Percentages identified for the topic areas represent the number of test questions assigned to each content area. These percentages do not necessarily reflect the content of future examinations.

10.00 Neurologic Development and Evaluation of the Fetus and Newborn (21%)
- Normal CNS development in the fetus, risk factors and outcomes
- Antepartum and intrapartum indicators of neurological risks to the fetus and neonate
- Comprehensive neurological exam identifying normal and abnormal findings

11.00 Neuro-monitoring, Imaging and Diagnostic Tools (17%)
- Neurological monitoring, Recognition of and General knowledge of EEG/aEEG
- Use of Neurologic Imaging to assess and modify treatment and evaluate prognosis

12.00 Assess and Manage Pathophysiologic States specific to the neurologically compromised or at-risk neonates and provide neuro protection (34%)
- Pathophysiology of neurologic injuries
- Prevention, management and maintenance of health for at risk neonates or those with neurologic injury

13.00 Assess and Manage Neuro-development, Psychosocial Behavioral States, Follow-up and Discharge (23%)
- Apply knowledge of Neurosensory environmental experiences
- Describe and manage stress and pain pathways and the impact on behavioral and physiological parameters
- Collaborate with health care providers to assess and manage psychosocial behavior states and evaluate social determinants of health, modify the plan of care and prepare for discharge

14.00 Professional Issues (EBP, Professional, Legal, Ethical, Safety) (5%)
EXAMINATION CONTENT

ASSOCIATED COMPETENCIES

- Identify antepartum and intrapartum indicators of neurological risk and their implications to the fetus and neonate.
- Systematically assess neonatal neurological status utilizing clinical neurological assessment skills and neuroimaging to differentiate abnormal from normal.
- Utilize and interpret bedside neuro-monitoring tools to identify alterations in cerebral function and perfusion and implement appropriate interventions.
- Apply knowledge of the pathophysiology of neurologic injuries in the neonate including risk factors, presentation, and outcomes to implement diagnostic, therapeutic interventions and plan of care.
- Develop an individualized plan of care for the prevention, maintenance and promotion of health for neonates at risk or those with neurological injuries or dysfunction to improve overall outcomes.
- Utilize knowledge of neurosensory development, pain and stress pathways and implement evidence-based strategies to minimize adverse outcomes in the at-risk neonate.
- Through ongoing communication with the family, evaluate discharge needs, psychosocial behavioral states and the social determinants of health and modify the plan of care in collaboration with other health care providers.
- Identify professional, legal and ethical issues that present when caring for neonates at risk for neurological injury or dysfunction.
STUDY GUIDE

NEUROLOGIC DEVELOPMENT AND EVALUATION OF THE FETUS AND NEWBORN

I. Physical, Gestational Age, Behavioral and Neurologic Assessment

- Critical periods of fetal CNS and sensory development
- Synaptogenesis
- Organization
- Migration
- Myelination
- Pruning
  - Apoptosis
  - Overproduction

II. Antenatal and intrapartum indicators of neurological risk to the fetus and neonate

- Maternal risk factors to fetal CNS development
  - Genetic predisposition
  - Maternal health
  - Placental health
  - Toxin exposure
  - Infection
- Neurological risks to the fetus and neonate during labor and delivery, stabilization and resuscitation and transition
  - Perinatal emergencies
  - Ineffective resuscitations
  - Equipment issues
  - Preterm labor and delivery

III. Comprehensive neurological exam identifying normal and abnormal findings

- Comprehensive neurological exam at all gestational ages
  - Head
    - Size
    - Shape
    - Sutures
  - Cranial Nerves
  - Neonatal reflexes
    - Deep tendon reflex
  - Tone
  - Posture
  - Movement
  - Level of consciousness
- Impact of pharmacological agents on the neonatal neurological exam
  - Benzo
  - Opioids
  - Maternal drugs
    - SSRI
    - Magnesium sulfate
- Abnormal findings
  - Dysmorphic features
  - Hair tufts
  - Dimples
  - Birth marks
  - Head
    - Cephalohematoma
    - Subgaleal hematoma
    - Caput
NEUROMONITORING, IMAGING AND DIAGNOSTIC TOOLS

I. Neuromonitoring, Recognition of and General knowledge of EEG/aEEG

• Cerebral monitoring
  EEG/aEEG/NIRS
    - clinical use
    - limitations
    - artifact

• Clinical Indications and significance of normal and abnormal findings of EEG/aEEG
  Background patterns
  Seizures

• Patient care needs during neurological monitoring
  Skin assessment and protection
  Event marking

II. Use of Neurologic Imaging to assess and modify treatment and evaluate prognosis

• Clinical indications of neuro imaging

• Identification of anatomical structures and recognition of significant neuro-imaging findings
  Intraventricular hemorrhage (IVH)
  Periventricular leukomalacia (PVL)
  Posthemorrhagic Hydrocephalus (PHH)
  Hypoxic Ischemic Encephalopathy (HIE)
  Stroke
  Intracerebral hemorrhage (ICH)
  subdural hemorrhage
  Subgaleal hemorrhage
  Congenital brain malformations

• Patient care needs during neurological imaging
  Skin protection
  Off unit transport
STUDY GUIDE

ASSESS AND MANAGE PATHOPHYSIOLOGIC STATES SPECIFIC TO NEUROLOGICALLY COMPROMISED OR AT RISK NEONATES AND PROVIDE NEUROPROTECTION

I. Pathophysiology of neurologic Injuries

For all injuries: incidence, etiology, clinical presentation, diagnostics, lab studies, treatments

- Hypoxic Ischemic Encephalopathy (HIE)
  Mechanism of injury
  Multisystem organ failure

- Neonatal stroke
  Arterial
  Cerebral Sino-venous thrombus (CSVT)

- CNS Malformation
  Anatomical
  Vascular
  Congenital hydrocephalus
  Neural tube defects

- Cranial deformities
  Plagiocephaly
  Craniosynostosis

- CNS infection
  Viral
    -HSV
    -CMV
    -Zika
  Bacterial

- Encephalopathy
  Metabolic/endocrine
    -Hypoglycemia
    -Inborn errors of metabolism
    -bilirubin
  Hepatic
    -Neonatal hemochromatosis
    -Hemophagocytic lymphohistiocytosis (HLH)
  Genetic

- Neonatal drug exposure
  Neonatal abstinence syndrome (NAS)
  Iatrogenic

- Neuromuscular disease
  Spinal muscular atrophy (SMA)
  Congenital myopathies

- Premature neonate
  Intraventricular hemorrhage (IVH)
  Periventricular leukomalacia (PVL)
  Posthemorrhagic Hydrocephalus (PHH)

- Birth injuries
  Subgaleal hemorrhage
  Brachial plexus

II. Prevention, Management and Maintenance of health for at risk neonates or those with neurologic injury

- Eligibility, contraindications and interventions to initiate therapeutic hypothermia (passive or active), maintaining treatment and rewarming
- Perinatal risk factors
  Encephalopathy staging
  Interpretation of cord gas
  Fluid and electrolyte and nutrition Complications

- Recognition and management of seizures
  Types
    - Subclinical/clinical
    - Phenobarbital

- Recognition and management of apnea
  Prematurity
  Central

- Interventions to prevent or minimize brain injury
  Positioning
  Delayed cord clamping
  Maternal and neonatal pharmacological agents
  Stabilize and maintain appropriate physiologic parameters
  Optimize ventilatory strategies
  Protected sleep

- Prevention of infection and systemic inflammation
  Central line-associated bloodstream infection (CLABSI)
  Necrotizing enterocolitis (NEC)
STUDY GUIDE

ASSESS AND MANAGE NEURO-DEVELOPMENT, PSYCHOSOCIAL BEHAVIORAL STATES, FOLLOW-UP AND DISCHARGE

I. Apply knowledge of neurosensory environmental experiences

- Neurosensory environmental experiences
  - Auditory
  - Visual
  - Vestibular
  - Olfactory
  - Tactile
- Therapeutic positioning
  - Neutral body alignment
  - Appropriate containment
  - Swaddle
  - Skin-to-skin
- Protected sleep
  - Environment of care
  - Maturation of sleep cycles
  - Negative effects of sleep deprivation
- Thermoregulation
  - Temperature instability
  - Consequences of hypo/hyperthermia
- Nutrition
  - Special considerations

II. Describe and manage stress and pain pathways and the impact on behavioral and physiological parameters

- Neurobehavioral development
  - Habituation
  - Motor organization
  - State organization
- Pain assessment
  - Special considerations for the neurologically compromised
  - Pain reassessment
- Neonatal pain management
  - Pharmacologic
  - Non-pharmacologic
- Stress response
  - Hormones and neurotransmitters
  - HPA axis
  - Stress cues
  - Toxic stress

III. Collaborate with health care providers to assess and manage psychosocial behavior states and evaluate social determinants of health, modify the plan of care and prepare for discharge

- Family centered care and integrations
  - Partnered care
  - Parental-neonatal attachment
  - Stress and separation
  - Participation in decision making and daily caregiving
  - Culturally and spiritually sensitive care
- Discharge/preparation/process
  - Developmental follow up
  - Specially follow up
  - Hearing screening
  - Family support
  - Teaching
    - SIDS prevention
    - Motor, cognitive and language delays
- End of life care/ palliative care/ grieving process
  - Non-initiation
  - Comfort care
  - Hospice
I. Identify professional and ethical issues in the care of neonates at risk or with neurological injury or dysfunction

- Evidence based research
- Risks and outcomes
- Benchmarking
- QI/process improvement
- Best practice guidelines and bundles
- Translocation science

- Professional practice
  - Communication
  - Teamwork
  - Continuity of care
  - Patient safety
  - Education and training
  - Compassion fatigue
  - Self-care

- Ethical and legal issues that impact the neurologically impaired neonate
- Life limiting conditions
STUDY RESOURCES

- Blackburn, Maternal, Fetal, & Neonatal Physiology, Elsevier, 2018