



Neurocritical Care Written Examination Content Outline

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The UCNS Neurocritical Care examination was established to determine the level of competence for Neurocritical Care specialists.

The following content outline is provided to examination candidates interested in the certification examination. The content outline consists of three primary categories followed by subcategories. A complete description of the core content required of Neurocritical Care specialists can be found in the Neuro-Intensive Care Core Curriculum at: http://www.ucns.org/certification/pdfs/core_curr_nic.pdf.

The written examination consists of 200 multiple choice questions.

	Content Area	Percentage of Questions
I.	Neurological Disease States	48%
II.	General Medical Critical Care	47%
III.	Procedural Skills	5%

I. Neurological Disease States: Pathology, Pathophysiology and Therapy

A. Cerebrovascular Diseases

1. Infarction and ischemia
 - a. Massive hemispheric infarction
 - b. Basilar artery occlusion and stenosis
 - c. Carotid artery occlusion and stenosis
 - d. Crescendo TIAs
 - e. Occlusive vasculopathies (Moya-Moya, sickle cell)
 - f. Spinal cord infarction
2. Intracranial hemorrhage
 - a. Supratentorial
 - b. Cerebellar
 - c. Brainstem
 - d. Intraventricular
3. Subarachnoid hemorrhage – aneurysmal and other

4. Vascular malformations
 - a. Arteriovenous malformations
 - b. AV fistulas
 - c. Cavernous angiomas
 - d. Venous angiomas
5. Dural sinus thrombosis
6. Carotid-cavernous fistulae
7. Cervical and cerebral arterial dissections

B. Neurotrauma

1. Traumatic Brain injury
 - a. “Diffuse axonal injury”
 - b. Epidural hematoma
 - c. Subdural hematoma
 - d. Skull fracture
 - e. Contusions and lacerations
 - f. Penetrating craniocerebral injuries
 - g. Traumatic subarachnoid hemorrhage
2. Spinal cord injury
 - a. Traumatic injury (transection, contusion, concussion)
 - b. Vertebral fracture and ligamentous instability

C. Disorders, Diseases, Seizures and Epilepsy

1. Seizures and Epilepsy
 - a. Status epilepticus
 - Convulsive
 - Non-convulsive
 - Myoclonic
2. Neuromuscular Diseases
 - a. Myasthenia gravis
 - b. Guillain-Barre syndrome
 - c. ALS
 - d. Rhabdomyolysis and toxic myopathies
 - e. Critical illness myopathy and neuropathy
3. Infections
 - a. Encephalitis (viral, bacterial, parasitic)
 - b. Meningitis (viral, bacterial, parasitic)
 - c. Brain and spinal epidural abscess
4. Toxic-metabolic Disorders
 - a. Neuroleptic malignant syndrome/malignant hyperthermia
 - b. Serotonin syndrome
 - c. Drug overdose and withdrawal (barbiturates, narcotics, alcohol, cocaine, acetaminophen).
 - d. Temperature related injuries (hyperthermia, hypothermia)
5. Inflammatory and Demyelinating Diseases
 - a. Multiple sclerosis (Marburg variant, transverse myelitis)

- b. Neurosarcoidosis
- c. Acute disseminated encephalomyelitis (ADEM)
- d. CNS vasculitis
- e. Chemical or sterile meningitis (i.e. posterior fossa syndrome, NSAID induced)
- f. Central pontine myelinolysis
- g. Others
- 6. Neuroendocrine Disorders
 - a. Pituitary Apoplexy
 - b. Diabetes insipidus
 - c. Panhypopituitarism
 - d. Thyroid storm and coma

D. Neuro-oncology

- 1. Brain tumors and metastases
- 2. Spinal cord tumors and metastases
- 3. Carcinomatous meningitis
- 4. Paraneoplastic syndromes

E. Encephalopathies

- 1. Eclampsia, including HELLP Syndrome
- 2. Hypertensive encephalopathy
- 3. Hepatic encephalopathy
- 4. Uremic encephalopathy
- 5. Hypoxic-ischemic and anoxic encephalopathy
- 6. MELAS

F. Clinical syndromes

- 1. Coma
- 2. Herniation syndromes with monitoring & ICP
- 3. Elevated intracranial pressure and Intracranial hypotension/hypovolemia
- 4. Hydrocephalus detection & treatment
- 5. Cord compression
- 6. Death by neurologic criteria, end of life issues, and organ donation
- 7. Vegetative state
- 8. Dysautonomia (cardiovascular instability, central fever, hyperventilation)
- 9. Reversible posterior leukoencephalopathy
- 10. Psychiatric emergencies (psychosis)

G. Perioperative neurosurgical care

H. Pharmacotherapeutics

II. General Critical Care: Pathology, Pathophysiology and Therapy –

A. *Cardiovascular Physiology, Pathology, Pathophysiology, and Therapy*

1. Shock (hypotension) and its complications (vasodilatory and cardiogenic)
2. Myocardial infarction and unstable coronary syndromes
3. Neurogenic cardiac disturbances (ECG changes, stunned myocardium)
4. Cardiac rhythm and conduction disturbances; use of antiarrhythmic medications; indications for and types of pacemakers
5. Pulmonary embolism
6. Pulmonary edema: cardiogenic versus noncardiogenic (including neurogenic)
7. Acute aortic and peripheral vascular disorders (dissection, pseudoaneurysm)
8. Recognition, evaluation and management of hypertensive emergencies and urgencies
9. Calculation of derived cardiovascular parameters, including systemic and pulmonary vascular resistance, alveolar-arterial gradients, oxygen transport and consumption

B. *Respiratory Physiology, Pathology, Pathophysiology and Therapy*

1. Acute respiratory failure
 - a. Hypoxemic respiratory failure (including ARDS)
 - b. Hypercapnic respiratory failure
 - c. Neuromuscular respiratory failure
2. Aspiration
3. Bronchopulmonary infections
4. Upper airway obstruction
5. COPD and status asthmaticus, including bronchodilator therapy
6. Neurogenic breathing patterns (central hyperventilation, Cheyne-Stokes respirations)
7. Mechanical ventilation
 - a. Positive pressure ventilation (including BIPAP)
 - b. PEEP, CPAP, inverse ratio ventilation, pressure support ventilation, pressure control, and non-invasive ventilation
 - c. Negative pressure ventilation
 - d. Barotrauma, airway pressures (including permissive hypercapnia)
 - e. Criteria for weaning and weaning techniques
8. Pleural Diseases
 - a. Empyema
 - b. Pneumothorax
9. Pulmonary hemorrhage and massive hemoptysis
10. Chest X-ray interpretation
 - a. End tidal CO₂ monitoring
 - b. Sleep apnea
 - c. Control of breathing

C. *Renal Physiology, Pathology, Pathophysiology and Therapy*

1. Renal regulation of fluid and water balance and electrolytes
2. Renal failure: Prerenal, renal, and postrenal
3. Derangements secondary to alterations in osmolality and electrolytes
4. Acid-base disorders and their management
5. Principles of renal replacement therapy
6. Evaluation of oliguria and polyuria
7. Drug dosing in renal failure
8. Management of rhabdomyolysis
9. Neurogenic disorders of sodium and water regulation (cerebral salt wasting and SIADH).

D. *Metabolic and Endocrine Effects of Critical Illness*

1. Enteral and parenteral nutrition
2. Endocrinology
 - a. Disorders of thyroid function (thyroid storm, myxedema coma, sick euthyroid syndrome)
 - b. Adrenal crisis
 - c. Diabetes mellitus
 - Ketotic and hyperglycemic hyperosmolar coma
 - Hypoglycemia
 - d. Disorders of calcium and magnesium balance
3. Systemic Inflammatory Response Syndrome (SIRS)
4. Fever, thermoregulation, and cooling techniques

E. *Infectious Disease Physiology, Pathology, Pathophysiology and Therapy*

1. Antibiotics
 - a. Antibacterial agents
 - b. Antifungal agents
 - c. Antituberculosis agents
 - d. Antiviral agents
 - e. Antiparasitic agents
2. Infection control for special care units
 - a. Development of antibiotic resistance
 - b. Universal precautions
 - c. Isolation and reverse isolation
3. Tetanus and Botulism
4. Hospital acquired and opportunistic infections in the critically ill
5. Acquired Immune Deficiency Syndrome (AIDS)
6. Evaluation of fever in the ICU patient
7. Central fever
8. Interpretation of antibiotic concentrations, sensitivities

F. Physiology, Pathology, Pathophysiology and therapy of Acute Hematologic Disorders

1. Acute defects in hemostasis
 - a. Thrombocytopenia, thrombocytopathy
 - b. Disseminated intravascular coagulation
 - c. Acute hemorrhage (GI hemorrhage, retroperitoneal hematoma)
 - d. Iatrogenic coagulopathies (Warfarin and heparin induced)
2. Anticoagulation and fibrinolytic therapy
3. Principles of blood component therapy (blood, platelets, FFP)
4. Hemostatic therapy (vitamin K, aminocaproic acid, protamine, factor VIIa)
5. Prophylaxis against thromboembolic disease
6. Prothrombotic states

G. Physiology, Pathology, Pathophysiology and Therapy of Acute Gastrointestinal (GI) and Genitourinary (GU) Disorders

1. Upper and lower gastrointestinal bleeding
2. Acute and fulminant hepatic failure (including drug dosing)
3. Ileus and toxic megacolon
4. Acute perforations of the gastrointestinal tract
5. Acute vascular disorders of the intestine, including mesenteric infarction
6. Acute intestinal obstruction, volvulus
7. Pancreatitis
8. Obstructive uropathy, acute urinary retention
9. Urinary tract bleeding

H. Immunology and Transplantation

1. Principles of transplantation (brain death, organ donation, procurement, maintenance of organ donors, implantation). **(see K.9)**
2. Immunosuppression, especially the neurotoxicity of these agents

I. General Trauma and Burns

1. Initial approach to the management of multisystem trauma
2. Skeletal trauma including the spine and pelvis
3. Chest and abdominal trauma - blunt and penetrating
4. Burns and electrical injury

J. Monitoring (Topics covered within the content areas)

1. Neuromonitoring
2. Prognostic, disease severity and therapeutic intervention scores
3. Principles of electrocardiographic monitoring
4. Invasive hemodynamic monitoring
5. Noninvasive hemodynamic monitoring

6. Respiratory monitoring (airway pressure, intrathoracic pressure, tidal volume, pulse oximetry, dead space, compliance, resistance, capnography)
7. Metabolic monitoring (oxygen consumption, carbon dioxide production, respiratory quotient)
8. Use of computers in critical care units for multimodality monitoring

K. Administrative and Management Principles and Techniques

1. Organization and staffing of critical care units
2. Collaborative practice principles, including multidisciplinary rounds and management
3. Emergency medical systems in prehospital care
4. Performance improvement, principles and practices
5. Principles of triage and resource allocation, bed management
6. Medical economics: health care reimbursement, budget development

L. Ethical and Legal Aspects of Critical Care Medicine

1. Death and dying
2. Forgoing life-sustaining treatment and orders not to resuscitate
3. Rights of patients, the right to refuse treatment
4. Living wills, advance directives; durable power of attorney
5. Terminal extubation and palliative care
6. Rationing and cost containment
7. Emotional management of patients, families and caregivers
8. Futility of care and the family in denial

III. Procedural Skills

A. General and Neuro-Critical Care

1. Central venous catheter placement; dialysis catheter placement
2. Pulmonary artery catheterization
3. Management of mechanical ventilation, including CPAP/BiPAP ventilation
4. Administration of vasoactive medications (hemodynamic augmentation and hypertension lysis)
5. Maintenance airway and ventilation in nonintubated, unconscious patients
6. Interpretation and performance of bedside pulmonary function tests
7. Direct laryngoscopy
8. Endotracheal intubation
9. Shunt and ventricular drain tap for CSF sampling
10. Performance and interpretation of transcranial Doppler
11. Administration of analgesedative medications, including conscious sedation and barbiturate anesthesia
12. Interpretation of continuous EEG monitoring
13. Interpretation and management of ICP and CPP data
14. Jugular venous bulb catheterization

15. Interpretation of S_{ijv}O₂ and P_{bt}O₂ data
16. Management of external ventricular drains
17. Management of plasmapheresis and IVIG
18. Administration of intravenous and intraventricular thrombolysis
19. Interpretation of CT and MR standard neuroimaging and perfusion studies and biplane contrast neuraxial angiography
20. Perioperative and postoperative clinical evaluation of neurosurgical and interventional neuroradiology patients
21. Performance of lumbar puncture and interpretation of cerebrospinal fluid results
22. Induction and maintenance of therapeutic coma and hypothermia