Session Number 315

CCRN-PCCN-CMC REVIEW: NEURO PART 2

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Content Description

This course prepares the critical care nurse for successful completion of the CCRN and PCCN examinations. In accordance with the AACN test plans for the CCRN and PCCN, this lecture will discuss the neurological illnesses and injuries identified on the blue print with an emphasis on possible questions that may be asked on these subjects in the examination. The lecture will discuss seizures, stroke, and intracranial hemorrhage and will cover diagnosis, assessment, treatment, and nursing interventions that may appear on the examination. There will be time allotted for sample questions to be discussed during the lecture.

Learning Objectives

At the end of this session, the participant will be able to:

1. Describe types of seizures and their treatment
2. Discuss identification and treatment of ischemic stroke
3. Describe presentation and treatment of intracerebral aneurysm and AV malformation
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<table>
<thead>
<tr>
<th>CCRN and PCCN</th>
<th>CCRN only</th>
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<tbody>
<tr>
<td>✔ Intracranial hemorrhage (subarachnoid, epidural, subdural)</td>
<td>✔ Aneurysm, AV malformation</td>
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<tr>
<td>✔ Seizure disorders</td>
<td>□ Encephalopathy</td>
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<tr>
<td>✔ Stroke</td>
<td>□ Head trauma</td>
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<td>□ Neurologic infections</td>
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<td></td>
<td>□ ICP monitoring</td>
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<td>□ Neurosurgery</td>
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Note for PCCN candidates: This presentation includes discussions of advanced devices such as ICP monitoring and administration of vasoactive medications. These topics will not be tested in the PCCN exam.

Exam Tip: Approximately 12% of the CCRN exam and 5% of the PCCN exam will focus on the neurologic system, which is 18 and 6 questions respectively.

I. Seizures
   A. Definitions
      1. Temporary involuntary electrical discharges in the brain.
   B. Seizure disorder
      1. A chronic disorder of abnormal, recurrent, excessive, and self-terminating discharge from neurons
      2. Periods between seizures vary widely
      3. Previously called epilepsy
   C. Definitions
      1. Tonus: degree of tone or contraction present in the muscle
      2. Clonus: repetitious pattern of rigidity and relaxation
      3. Aura: a premonitory sensation at the beginning of a seizure
      4. Prodromal: symptoms occurring before a seizure
      5. Ictus: seizure
      6. Postictal: period immediately after a seizure
   D. Etiology
      1. Inadequate levels of seizure medications
      2. Withdrawal from seizure medications
      3. Acute withdrawal from chronic use of sedatives or depressants
         - Alcohol
         - Benzodiazepines
Barbiturates

4. Drug toxicity or adverse reaction
5. Metabolic disorders
   Uremia
   Hypoglycemia
   Electrolytes
   Fever
   Nutrition

6. Neurologic pathologic conditions
   Traumatic brain injury
   CNS infections
   Brain tumors
   Cerebral edema
   Stroke
   Cerebral anoxia
   AV malformation
   Increased ICP
   Heredity

E. Classification

1. Generalized
   a. Initial involvement of both cerebral hemispheres
   b. Tonic-clonic (previously called “grand mal”)
      Loss of consciousness followed by brief period of muscle rigidity
      (tonic phase) and then rhythmic muscle jerking (clonic phase)
      May see incontinence, diaphoresis
      Post-ictal phase
      Period following seizure
      May see headache, amnesia confusion, fatigue
   c. Myoclonic
      Sudden, brief muscular contractions, either generalized or
      localized to extremities or face

   c. Absence (previously termed “petit mal”)

2. Partial
   a. Seizures limited to part of one cerebral hemisphere
   b. Simple partial – patient conscious, no change in LOC, motor/sensory
   c. Complex partial – LOC impaired
      May progress to general
   d. Symptoms related to area of brain affects
      Motor – face twitching, limb jerking
      Automatisms – lip smacking, blinking
      Sensory – numbness, tingling
      May be visual, auditory, gustatory (taste) or vertiginous
      (vertigo, dizziness)
      Psychic – Hallucination, illusion
      Autonomic – diaphoresis, vomiting
F. Intervention
   1. Observation
   2. Prevent injury
   3. Search for cause
   4. Anti-epileptic drugs (AEDs)
   5. Surgery

G. Assessment
   1. Ictal
      Precipitating events
      Character of movement
      Duration
      Body parts involved
      Eye deviation
      Continence
   2. Post-ictal
      Duration
      Behavior
      Movement
      Amnesia

H. EEG Monitoring
   1. Records the amplified electrical potential of the brain by placing 14-21
      electrodes on the patient’s scalp
   2. Tracings reflect the combined electrical activity of several neurons
   3. Electrical pattern altered by different activity

I. To Treat Or Not To Treat
   1. What are the circumstances of the seizure?
   2. What is the patient’s medical condition?
   3. Has the patient responded to treatment?
   4. What is the patient’s quality of life?
   5. When was the last seizure?

J. Treatment: Basic Rules
   1. Select a drug for specific seizure type
   2. Monotherapy
   3. Polytherapy or different agent if unsuccessful
   4. Titrate the dose to achieve appropriate blood concentration or clinical control
   5. Consideration of side effects

K. Medication

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<tr>
<th>Drug</th>
<th>Indication</th>
<th>Dose</th>
<th>Adverse effects</th>
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<tbody>
<tr>
<td>Phenytoin (Dilantin)</td>
<td>Generalized Status epilepticus (if benzodiazepine ineffective)</td>
<td>15-20 mg/kg IV in NSS only at no more than 50 mg/min</td>
<td>Hypotension, bradycardia, cardiovascular collapse</td>
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<tr>
<td>Fosphenytoin (Cerebyx)</td>
<td>Generalized Status epilepticus</td>
<td>Dosed as phenytoin equivalents</td>
<td>Same as phenytoin</td>
</tr>
<tr>
<td>Drug</td>
<td>Indication</td>
<td>Dose</td>
<td>Adverse effects</td>
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<tr>
<td>Valproic acid</td>
<td>absence or multiple seizure types</td>
<td>20 mg/kg PE IV no more than 150 mg PE/min</td>
<td>Sedation, tremors, hepatic toxicity</td>
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<tr>
<td>(Depakote)</td>
<td>Especially useful for patients with</td>
<td>Compatible with glucose</td>
<td>Thrombocytopenia</td>
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<td></td>
<td>more than one type of generalized seizure</td>
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<tr>
<td>Carbamazepine</td>
<td>Partial seizures, especially complex</td>
<td>15-60 mg/kg/day IV or PO</td>
<td>Blood dyscrasias</td>
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<tr>
<td>(Tegretol)</td>
<td></td>
<td>Infuse IV at no more than 20 mg/min</td>
<td>Stevens-Johnson syndrome (particularly</td>
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<td></td>
<td></td>
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<td>in Asian population)</td>
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<td>Test for gene</td>
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L. Surgical Intervention
   a. Mapping
   b. Temporal lobectomy
   c. Corpus callosotomy
   d. Hemispherectomy

M. Special Considerations: Women
   1. Reproductive education
   2. Increased osteoporosis risk due to decreased bone mineral density
      a. Dilantin
      b. Tegretol
   3. Risk versus benefit
   4. Medication regimen adjustment may be necessary for women attempting conception

N. Special Considerations: The Elderly
   1. Highest incidence of new onset of epilepsy other than children under age 5
   2. Risk factors: stroke, head trauma, dementia, infection, alcoholism
   3. May be difficult to diagnose
   4. Consider the pharmokinetics of AEDs
   5. Consider drug interactions
   6. Consider cost of AEDs
   7. Begin treatment with monotherapy at low doses
O. Alcohol Withdrawal Seizures
   1. Occur in 33% of heavy drinkers within 7-30 hours of cessation or reduction of ETOH intake
   2. Seizure risk persists for 48 hours
   3. Seizures are usually single, self-limiting
   4. Delirium Tremens may occur 3-4 days after cessation of drinking
      Profound disorientation & agitation
      Hallucination
      Severe autonomic instability
   5. Treatment
      Diagnostic testing
      CT recommended for first episode or persistent seizure activity
      Focal findings
      Evidence of trauma
   6. Medical management
      AED not effective
      Education!

P. Status Epilepticus
   1. More than 10 minutes of continuous seizure activity
   2. Two or more sequential seizures without full recovery of consciousness between seizures
   3. Etiologies
      Non compliance with seizure medications
      CNS infections
      Drug intoxication
      Anoxia
      Trauma
      Electrolyte imbalance
      Fevers
   4. Treatment
      ABC’s
      Stop the seizure
      Ativan
      Valium
      Load with Dilantin
      Phenobarbital
      Pentobarbital or propofol
      Look for causes
      Prevent recurrence
      Prevent complication

II. Stroke
   A. Stroke or Brain Attack
1. Definition: Neurological changes brought about by an interruption in blood supply to the brain
   Third leading cause of death
   750,000 new or recurrent strokes a year
   160,000 die each year
   4 million disabled

B. Symptoms of Stroke
   1. Paralysis
      Hemiplegia
      Hemiparesis
   2. Sensation
   3. Speech
      Aphasia
      Expressive
      Receptive
   4. Motor Dysfunction
   5. Visual Changes
   6. Integrative Sensory Dysfunction
   7. Spatial Awareness Dysfunction
      Unilateral neglect

C. Types of stroke
   Transient Ischemic Attack (TIA)
   Ischemic (85%)
      Thrombotic (large artery)
      Embolic
   Hemorrhagic (15%)
      Subarachnoid hemorrhage
      Intracerebral hemorrhage
   Transient Ischemic Attack
      Ischemic event under one hour without permanent neurological deficit
      TIA is an emergency
   Ischemic Stroke
      Due to thrombosis or embolism
      Lodges in cerebral artery
      Causes ischemia of distal tissue
      Causes
      Valvular heart disease
      Afib
      MI
      Atherosclerosis of ascending aorta
   Hemorrhagic Stroke
      Due to a ruptured cerebral artery
      Artery bleeds out
      Puts enormous pressure on surrounding tissue
      Brain tissue dies

D. Modifiable Risk Factors
HTN
Cardiac Risks
  Cholesterol/lipids
  Heart-bypass, angioplasty
  A Fib
Smoking
Narrowing of Carotid arteries

Sickle Cell anemia
High dose birth control pills and smoking
Illicit drugs
HRT Estrogen and progesterone
Alcohol
Obesity
Diabetes

E. Non-modifiable Risk Factors
  Age
  Sex
  Race/Ethnicity
  Family History

F. Pathophysiology of Ischemic Stroke
  Central core area of hypoxia due to ischemia lasting > 4 –6 minutes→ cellular
  ATP depleted→ anaerobic metabolism→ lactic acid accumulates→ cell death ensues
  Ischemic “PENUMBRA” = surrounding area of cerebral edema & cerebral
  inflammation→ free radicals & inflammatory mediators released → further
  peripheral cell death occurs

G. Diagnostic Work-up in ER
  Non contrast CT scan
  Quick history and physical-stress time of onset
  12 lead EKG
  Chest x-ray
  Start IV line
  Labs
    CBC
    Electrolytes
    Glucose
    BUN/Creatine
    PT/PTT
    NIHSS

H. NIH Stroke Scale (NIHSS)
  Assesses
    Level of consciousness
    Vision and gaze
    Facial palsy
    Extremity weakness
    Limb ataxia
    Sensory loss
    Language and dysarthria,
    Neglect
  Total ranges from 0-42
  0 all normal findings
42 fully impaired
>22 severe stroke

I. Initial Management for Ischemic Stroke
  r-TPA- within 3 hours of symptom onset
  Inform patient and family of risks
Exclusion criterion
  Evidence of ICH
  Suspicion of SAH
  Recent stroke, intracranial or intraspinal surgery
  Serious head trauma ≤ 3 months
  Major surgery or serious trauma in previous 14 days
  Arterial puncture at a noncompressible site or LP in last 7 days
  Major symptoms that are rapidly improving or NIHSS <4
  Hx of ICH
  Uncontrolled htn at time of tx
    Systolic BP >185 or diastolic BP >110 mm Hg
  Seizure at stroke onset
  Active internal bleeding
  Intracranial neoplasm, AVM, or aneurysm
Known bleeding diathesis
  Current use of anticoagulants or PT>15 seconds INR>1.7
  Use of heparin in the previous 48 hours and a prolonged PTT
  Platelet count <100,000
  Blood glucose <50 mg/dl or >400mg/dl

Dose
  0.9 mg/kg; maximum of 90 mg
  10% of dose-bolus
  Followed by infusion over 60 minutes

Post TPA care
  Avoid invasive procedures (Foley, NG tubes, etc)
  Monitor closely for ICH
  Monitor BP and treat according to AHA guidelines

Diagnostic work-up after thrombolytic
  MRI-MRA
  Carotid Doppler
  Transcranial Doppler
  Echocardiogram/TEE

J. Medical Management if r-TPA not given
  Heparin Continuous IV infusion for 2-3 days
  Action
    Interferes with interaction of thrombin with fibrinogen
    Prevents conversion of prothrombin to thrombin
    Prolongs whole blood clotting time
  Indications
    Ischemic strokes only
    Cardio-embolic strokes/Stroke in evolution
Contraindications

Hemorrhagic stroke

Coumadin (warfarin)

Indications: Pt converted from Heparin to Coumadin for long-term therapy
Goal: INR 2-3

Platelet Antiaggregation Medications

ASA
Persantine
Plavix
Aggrenox

- ASA and Persantine

K. Surgical Management

Carotid endarterectomy

Objective is to restore normal perfusion pressure to internal carotid system and removal of emboli

Indication:
Carotid stenosis greater than 70% and symptomatic

L. Hemorrhagic Stroke

1. Intracerebral hemorrhage (ICH)
   a. Onset usually during activity that causes increased ICP
   b. Sx: based on location, progressive onset
   c. Diagnosis and treatment
      1. Non-contrast CT
      2. BP control
      3. Correct coagulopathy
      4. Medical vs. non-medical mgt dependent on size/location

2. Subarachnoid hemorrhage: “worst headache of my life”
   a. Incidence
      Heredity not a factor per se, but families are encouraged to be tested
      Occurs in about 1/10,000
      More frequently in women
      Peak age is about 50, but can occur at any age
   b. Causes of SAH
      Trauma
      Aneurysm
      AVM
      Neoplasm
   c. Diagnosis and treatment
      1. Non-contrast CT
      2. If no space-occupying lesion → LP
      3. Angiogram
      4. Definitive treatment (clipping vs. coiling)
   d. BP management
      1. Tolerate higher BP for secured aneurysm
      2. Antihypertensives for unsecured aneurysms
e. Complications

1. Re-bleeding
   a. Acute neurologic deterioration
   b. Peak: 24 hours after initial bleed
   c. Treatment = clipping

2. Hydrocephalus
   a. Acute requiring ventriculostomy
   b. Chronic requiring ventriculo-peritoneal shunt

3. Vasospasm
   a. Narrowing of vessel lumen
   b. Progressive neurologic deterioration
   c. Most significant cause of mortality and morbidity in patients surviving long enough to reach medical care
   d. Onset
      Peak 7-14 days post SAH up to 21 days
   e. Vasospasm Prevention
      Triple H therapy
      - Hypertension, Hypervolemia, Hemodilution
      - Hct < 40
      - Albumin, IV fluids
      - SBP ~ 150mmHg
      - May require vaspressors
      - Selective Calcium channel blockers: Nimodipine 60 mg
         Every four hours ATC for 21 days
   f. Treatment: Selective cerebral angioplasty

3. Arteriovenous malformation (AVM): congenital abnormal collection of blood vessels
   a. Most common presentation: hemorrhage or seizure
   b. Diagnosis and treatment: MRI and angiography
   c. Treatment based on size and appearance of AVM
      1. Surgery vs. INR

Aneurysms

Occur at bifurcations and small tortuous vessels
Usually silent, but grow larger and weaker over time, until burst
May be multiple, occurring along same vessel, or mirror images on opposite sides

Presentation

Sentinel H/A described as “worst headache of life”
   - Often accompanied by a “popping” or “bursting” noise in head
   - Can occur with or without previous history of migraines
   - Associated with severe physical or emotional strain, i.e. heavy lifting, straining at BM, coitus, severe grief, or arguments

Aneurysmal Causes
Trauma
Congenital
Drugs
Diseases
Infection

Other Risk Factors
HTN
Diabetes
Smoking
Atherosclerosis

Morbidity and Mortality
30% die immediately
30-40% die within the first 30 days
Of those who survive, 60% will have serious neurological disability

Diagnosis
History/Physical
Noncontrast CT scan
Lumbar puncture
Diagnostic Arteriogram
MRI/MRA

Initial Management/Unsecured
Control MAP (less than 90)
Intubate/Sedate, if necessary
Ventriculostomy for control of ICP

Secured Aneurysm
Coiling (Interventional Radiology)
Clipping (Surgery)

Medical Therapies
Pain Management
Can not use drugs that will mask the neurological exam
Codeine, with or without Tylenol
Ice, rest, and decreased stimulation helps
Nimodipine
Effective against vasospasm
Watch for hypotension
Give every 6 hours RTC for 21 days
Steroids
Reduces cerebral edema
Use is controversial

Anticonvulsants
Dilantin, non-sedating

Neosynephrine
Preferred vasopressor
Crosses Blood-Brain-Barrier
Beneficial effects on vasospasm
Improves CPP

Mannitol
Pentobarbital

Complications
Rebleed
Peak incidence first 24 hours after initial hemorrhage
Leading cause of death in those who survive initial bleed
Stabilization of the aneurysm should prevent rebleeding

Vasospasm
Leading cause of delayed morbidity/mortality after initial bleeding
Leads to ischemia
Peak onset day 5-15 after bleed
Can last up to 3 weeks after onset
H-H-H Therapy: Hypertension, Hypervolemia, Hemodilution

Hypertension
Goal MAP 100-130
Neurological exam may improve solely because of reperfusion
Fluids first, then neosynephrine if fluid overloaded

Hypervolemia
Fluid boluses
PA catheter, calculate Starling Curve to determine optimum wedge
No diuretics for fluid overload, can precipitate re-bleeding
May require intubation

Hemodilution
Make blood “thinner” to force blood into narrowed vessels
Mannitol every 6 hours
Monitor serum osmolarity

Flat Bed Rest
Overcome gravity and aids in perfusion
Awake patients can eat meals at 30 degrees but must lay down immediately after eating

Certification Questions
1. A patient presents with flu-like symptoms, lymphadenopathy, a diffuse erythematous rash, and severe muscle weakness. The nurse admits the patient for close monitoring and further diagnostic workup to identify the cause of these findings. The patient suddenly loses consciousness followed by a brief period of muscle rigidity and then rhythmic muscle jerking. The best immediate course of action for the nurse is to
A. Obtain a serum laboratory specimen for STAT identification of a disease-specific antigen or antibody causing this syndrome
B. Observe, record, and report all details of these clinical events to the physician as soon as these muscular movements have subsided
C. Administer benzodiazepine per standing order to stop the seizure activity
D. Quickly apply soft restraint to prevent injury

2. When providing nursing care for a patient with suspected stroke, the most important factor related to the use of fibrinolytic therapy is to:
   A. Begin the therapy within 90 minutes of the patient’s arrival
   B. Obtain a detailed history of the patient’s allergies
   C. Establish the nature and time of symptom commencement
   D. Start a large-bore central IV line

3. A nurse has just admitted a patient with a diagnosis of acute ischemic stroke to the ICU. Which of the following assessment findings should alert the nurse to a contraindication for rt-PA therapy?
   A. NIH stroke scale score of 1
   B. History of seizure disorder
   C. A mild traumatic brain injury from a motor vehicle collision 6 months ago
   D. INR greater than 1.3

4. A patient was admitted to ICU yesterday evening after being found on the pavement following an apparent assault. The patient has not yet been identified, and his medical history is unknown. He has been clinically stable and maintained on mechanical ventilation with satisfactory ABGs. During a mid-morning assessment, the nurse notes that the patient demonstrates a rhythmic movement of his extremities and begins clenching his jaw on the endotracheal tube. He has not demonstrated this type of activity since admission, but was placed on prophylactic anticonvulsants after traumatic brain injury. The nurse hypothesizes that the patient is most likely experiencing:
   A. Hypoxia
   B. Delirium tremens
   C. Substance withdrawal
   D. Post-traumatic seizures
Bibliography


