Exploring the Posterior Cerebral Artery Circulation: A Case Study Presentation of Syndromes Associated with Posterior Cerebral Artery Stroke

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November 1, 2018
Sixth Annual Neuro Nursing Symposium
Baptist Health South Florida
Coconut Grove, Florida

Disclosures

I have no actual or potential conflict of interest in relation to this program/presentation, which includes the discussion of any off label medication use.

Abstract

Ischemic strokes that involve the posterior circulation account for approximately 20% of all strokes, and often present with a variety of symptoms which may appear vague and sometimes non-specific. It is important for the clinician to be alert to these symptoms because early recognition and prompt treatment can often prevent severe complications, disability or even death. These symptoms can include, but are not limited to visual field deficits, sensory deficits, cranial nerve impairment, ataxia, dysarthria, or dysphagia which can often indicate the exact area of injury to the posterior circulation. Utilizing a case study approach, we will examine the anatomy of the posterior cerebral circulation and common locations of injury. We will also examine, in detail, the neurologic syndromes associated with specific posterior circulation ischemia, the detailed neurologic symptoms associated with each syndrome, and the nursing interventions utilized in the care of this critically ill patient population.
Learning Objectives

- Describe the anatomy of the posterior cerebral circulation and the major structures that are supplied, and the symptoms that are associated with ischemic strokes which involve the posterior circulation
- Describe the specific neurologic syndromes associated with the posterior cerebral, basilar and vertebral artery circulation
- Discuss the nursing interventions and multidisciplinary approach utilized in the care of the patient with a posterior cerebral circulation stroke.

Ischemic Stroke

- ~ 80% of all strokes are ischemic strokes
- Caused by a narrowing (thrombus) or blockage (embolus) of an artery to the brain
- Two types of ischemic stroke:
  - Embolic stroke occurs when a blood clot forms elsewhere in the body, and travels to the brain causing a blockage in blood flow i.e. DVT, PFO, Atrial Fibrillation
  - Thrombotic stroke occurs when a thrombus is formed in a artery leading to the brain, thereby reducing, or occluding blood flow to the brain i.e. carotid artery disease

Hemorrhagic Stroke

- Approximately 13% of all strokes are hemorrhagic
- There are 2 main types of hemorrhagic stroke
  - Intracerebral hemorrhage – most common type
    - Hypertension
    - Amyloid angiopathy
  - Subarachnoid hemorrhage
    - Aneurysm rupture
    - Arterial Venous Malformation (AVM)
    - Bleeding disorders
    - Trauma
    - Anticoagulation
STROKE RISK FACTORS

- A family history of stroke, heart attack or TIA
- Being age 55 or older
- High blood pressure — a systolic blood pressure of 120 millimeters of mercury (mm Hg) or higher, or a diastolic blood pressure of 80 mm Hg or higher
- High cholesterol — a total cholesterol level of 200 milligrams per deciliter (mg/dL), or 5.2 mmol/L, or higher
- Cigarette smoking
- Diabetes
- Obesity — a body mass index of 30 or higher
- Cardiovascular disease, including heart failure, a heart defect, heart infection, or abnormal heart rhythm
- Previous stroke or TIA
- High levels of homocysteine, an amino acid, in your blood
- Use of birth control pills or other hormone therapy

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**Anterior cerebral artery (ACA) territory**

**Posterior cerebral artery (PCA) territory**

**Middle cerebral artery (MCA) territory**

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**TERRITORY OF PCA:**

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Midbrain / Brainstem Structures

Stroke Syndromes Associated with Infarcts of the Cortex

• Primary Visual Field Cut
• Anton Babinski Syndrome
• Balint Syndrome
• Alexia without Agraphia
• Visual Agnosia

Assessments of the Visual Fields

• Assessment of central and peripheral vision
• Extra Ocular Movements (EOM’s) CN III, IV, & VI
• Accommodations
• Ptosis – CN III damage, or other causes
• Assessment of visual fields
• More accurate tests available (Neuro-ophthalmology)
• Ability to detect subtle abnormalities with patients visual fields
Deficits of the Primary Visual Field

Quadrantanopia  
Hemianopia

Boston Aphasia Assessment

Cortical Blindness

Cortical Blindness: in which your eyes work mechanically (EOMs) but your brain can't interpret the information.
Anton Babinski Syndrome

- **Definition:**
  - Describes the condition when patient's deny their blindness despite objective evidence of visual loss. It is a rare extension of cortical blindness in which in addition to the injury to the occipital cortex, other cortical centers are also affected with patients behaving as if they were sighted.
  
- Patient exhibits inability to name objects, and ADDITIONALLY will confabulate answers to questions.
  
- i.e. When clinician asked patient with bilateral occipital lobe PCA strokes to identify an object, patient stated a completely different object.

Agnosia

- **Definition:** the inability to recognize the import of sensory impressions; the varieties correspond with several senses and are distinguished as auditory (acoustic), gustatory, olfactory, tactile, and visual.
  
  - finger agnosia loss of ability to indicate one's own or another’s fingers.
  - tactile agnosia inability to recognize familiar objects by touch.
  - time agnosia loss of comprehension of the succession and duration of events.
  - Visual agnosia inability to recognize familiar objects by sight, usually due to a lesion in one of the visual association areas. Called also object blindness and psychic blindness.
  - visual-spatial agnosia (visuospatial agnosia) lack of the ability to analyze and orient using visual representations and their spatial relationships.
Anosognosia

- The condition in which a person who suffers illness or disability seems unaware of or denies the existence of his or her illness/disability because of an infarct; may include unawareness of quite dramatic impairments, such as blindness or paralysis
- i.e. the inability to recognize one’s own disease or impairment
- The inability to recognize the agnosia

Anton’s Syndrome

Visual Agnosia

- Visual agnosia is can be divided into two different categories:
  - Appereceptive agnosia - refers to individuals who cannot properly process what they see, meaning they have difficult identifying shapes or differentiating between different objects (visual stimuli)
  - Associative agnosia – When individuals cannot match an object with their memory. They can accurately describe an object and even draw a picture of the object, but are unable to state what the object is or is used for
Balint Syndrome

- First described by Rezso Balint, a German Neurologist in 1909 where patients have a clinical triad of visuospatial deficits
- Caused by bilateral parietal/occipital lobe lesions or injury – or even lateral gun shot wounds
  - Oculomotor Apraxia - Psychic paralysis of gaze
    - Inability to voluntarily shift to an object of interest despite unrestricted ocular movement
  - Optic Ataxia
    - The difficulty to accurately reach for an object despite adequate limb strength to do so
  - Simultanagnosia
    - The inability to perceive multiple objects in a scene at the same time

Simultanagnosia

Alexia without Agraphia

- Alexia without agraphia is a disorder of higher visual function where patients can still write but are unable to read (disconnected syndrome)
- Related to lesion in the left visual cortex
- The differential diagnosis of alexia includes reading problems due to hemianopia, attentional deficits, eye movement abnormalities, and linguistic problems.
Functions of the Thalamus
• Involvement in wakefulness, attention and motivation
• Manages our sensitivity to light, touch and temperature
• Facilitates the coordination of visual, auditory and motor information
• Pain
• Balance and awareness
• Emotional experiences and personality / expressions

The Artery of Percheron
• The thalamus is supplied by the paramedian arteries (perforators), usually emerging directly from the first segment of posterior cerebral arteries on both side
• Prevalence of the Artery of Percheron is unknown amongst the population

Artery of Percheron, n.d. Retrieved March 3, 2018
http://crashingpatient.com/medical-surgical/ischemic-stroke.htm/
Artery of Percheron Stroke

- Bilateral paramedian thalamic involvement is usually characterized by a triad of altered mental status, vertical gaze palsy, and memory impairment
- If the midbrain is also involved, then symptoms could include decreased levels of consciousness or coma (midbrain involvement)

Dejerine-Roussy Syndrome

- Also referred to as Thalamic Pain Syndrome
- Develops after a thalamic stroke
- Patients usually have suffered a previous stroke, often a thalamic lesion
- This sometimes can lead to debilitating neuropathic pain
- Thought to be caused by spinothalamic dysfunction

Dejerine-Roussy Syndrome

Criteria for Thalamic Pain Syndrome

- Development of pain with onset after a stroke
- Pain located on the stroke affected side of the body
- No other plausible cause of the pain, including pain isolated to the shoulder joint and nearby region
Weber Syndrome
Caused by an infarction of the midbrain secondary to an occlusion of the paramedian branches of the posterior cerebral artery
• Substantia Nigra
• Corticospinal fibers
• Corticobulbar tract
• Occulomotor nerve fibers

Weber Syndrome Symptoms
Structures involved:
• substantia nigra - basal ganglia innervate the ipsilateral hemisphere motor field, leading to a movement disorder of the contralateral body.
• corticospinal fibers - contralateral hemiparesis and typical upper motor neuron findings. It is contralateral because it occurs before the decussation in the medulla.
• corticobulbar tract - difficulty with contralateral lower facial muscles and hypoglossal nerve functions.
• occulomotor nerve fibers - ipsilateral oculomotor nerve palsy which leads to diplopia (CN III)
Locked In Syndrome (aka Basilar Artery Occlusion)

- A pontine infarct where the midbrain is preserved
- CN III is intact so the patient can open his/her eyes and vertical eye movements are preserved.
- The patient is conscious with preserved cognitive function but cannot move or communicate to the complete paralysis of all voluntary muscles of the body.
- The most common cause of brainstem stroke is a thrombosis of the basilar artery

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Millard-Gubler Syndrome

- AKA Ventral Pontine Syndrome, is a crossed paralysis syndrome where CN VI and CN VII are affected, resulting in contralateral body motor and sensory disturbances
- Ipsilateral facial and contralateral body hemiplegia due to pyramidal tract involvement
- Diplopia that is worsened while the patient looks toward the lesion
- Ipsilateral facial paresis and loss of corneal reflex

Medulla / Brainstem Structures

Wallenberg Syndrome

Occlusion of Vertebral artery supplying the Medulla resulting in the following symptoms:

- Vestibulocerebellar symptoms
- Autonomic dysfunction: Horner’s Syndrome, hiccups
- Sensory symptoms: Initially abnormal stabbing pain over the ipsilateral face then loss of pain and temperature sensation over the contralateral side of body
- Ipsilateral bulbar muscle weakness: Hoarseness, dysphonia, dysphagia, Dysarthria and diminished gag reflex
Nursing Interventions in Acute Care

**Prevention of secondary damage**
- Thrombolysis
- Blood pressure management
- Glucose management
- Self awareness of affected limbs
- Patients with hemiplegia should be approached from unaffected side
- Education regarding lifestyle changes to prevent risk of further infarcts

Nursing Interventions

**Thorough Neurological Exams!!**
- Detailed Neurological exam
- Education to patient and family about stroke risk factors
- Blood pressure monitoring to prevent hemorrhagic conversion in the setting of ischemic stroke
Dizziness or Vertigo

- Common symptoms of Posterior circulation strokes include vertigo, imbalance, hemiplegia, dysarthria, diplopia, headache, n/v, visual field deficits
- 7.5 million patients present to the ambulatory setting with c/o dizziness or vertigo
- Study was completed that evaluated 1666 patients who presented with dizziness or vertigo to the Emergency Department
- Of those individuals, 3.2 % were found to have stroke


Nursing Interventions

- Multidisciplinary Approach to keep this high risk patient safe, in addition to nursing
- PT, OT
- Speech Therapy
- Psychiatry, Physiatry, Neurology
- Social Work
- Care Coordination
- FAMILY!!

- Safety rounds:
  - Frequent monitoring of patient to ensure safety
  - Bed Alarm, Chair Alarm, location near nursing station
  - Discouraged use of physical or chemical restraints
  - 1:1 sitter at first, to help maintain patient safety
  - Restraint alternative cart
Rehabilitation after hospitalization

• Continued support for family
• Social Work
• Care Coordination

• Need for continued therapy
• Physical Therapy
• Occupational Therapy
• Speech Therapy

Conclusion

• Posterior Cerebral Artery stroke is less common than anterior circulation strokes (about 20%), and has a specific subset of symptoms
• Symptoms from PCA stroke may not be immediately recognizable because of other confounding factors
• Diligent nursing neurological assessment is key, and helps create a safe environment for this patient population

• You may not remember the exact “syndrome” associated with the PCA stroke, but you recognized the neurological deficit, which led to further workup!

• Multidisciplinary commitment to patient safety is essential to the proper care for patient with PCA stroke
• Family participation is encouraged to make the road to rehabilitation more successful

References

References


Thank You!
Special Thank You to Dr. Steven Feske
Director of Stroke Neurology
Brigham and Women's Hospital
Boston, MA

Questions?
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