

# AMERICAN ACADEMY OF NEUROLOGY STROKE AND VASCULAR NEUROLOGY FELLOWSHIP CORE CURRICULUM

## Definition

Stroke and vascular neurology focuses on vascular disorders that can lead to ischemic stroke, intracranial hemorrhage, and spinal cord ischemia and hemorrhage.

The practice of stroke and vascular neurology requires an interdisciplinary approach that incorporates knowledge of relevant aspects of basic science, epidemiology, clinical neurology, diagnostic and interventional radiology, neurosonology, cerebral blood flow/metabolism, neurological critical care, neurobehavior and neurorehabilitation. The body of evidence that forms the basis of the prevention and treatment of stroke is complex and necessitates specific training in medical school and residency that may be supplemented through a focused fellowship.

## Appendix

### CORE KNOWLEDGE FOR STROKE FELLOWSHIP

#### I. STROKE MECHANISMS

##### A. General Mechanisms of Stroke

1. Atherosclerosis
  - a. common anatomical sites
  - b. pathophysiology: cellular response, cytokines, lipids, plaque development and progression
  - c. prevention strategies
2. Thrombosis
  - a. coagulation cascade
  - b. platelet and coagulation system interactions
  - c. endogenous fibrinolytic system
3. Biochemical changes in brain ischemia. Current concepts of:
  - a. excitotoxicity and mediator/inhibitory mechanisms
  - b. calcium homeostasis and calcium-related ischemic damage
  - c. reperfusion injury
  - d. the ischemic penumbra
  - e. endothelial cell activity
4. Hemorrhage.

##### B. Pathophysiology of Brain Ischemia and Hemorrhage

##### C. Pathology of stroke.

##### D. Mechanisms of brain ischemia

1. Cardiogenic brain embolism
  - a. atrial fibrillation

- b. valvular abnormalities
- c. cardiomyopathies
- d. atrial septal abnormalities
- e. endocarditis
- 2. Large vessel atherosclerosis.
  - a. Anterior circulation.
  - b. Posterior circulation.
- 3. Aortic arch embolism
- 4. Small artery occlusive disease
  - a. small deep infarcts
  - b. white matter disease
- 5. Hemodynamic brain ischemia
- 6. Migraine
- 7. Pregnancy and hormonal contraception
- 8. Hereditary and acquired hypercoagulable states
- 10. DIC, TTP, other hematological disorders.
- 11. Antiphospholipid antibody syndromes
- 12. Sickle cell disease
- 13. Substance abuse and drug toxicities
- 14. Hypertensive encephalopathy
- 15. Arterial dissection
- 16. Fibromuscular dysplasia
- 17. Vasculopathies including inflammatory, infectious, Moya-moya.
- 18. Cerebral venous thrombosis
- 19. Genetic causes including CADASIL
- 20. Metabolic disorders (MELAS syndrome)

E. Mechanisms of Hemorrhagic Stroke)

- 1. Intracerebral hemorrhage (ICH)
  - a. hypertensive
  - b. amyloid angiopathy
  - c. vascular malformations
  - d. drug or vasculitis related
  - e. hematologic disorders
- 2. Aneurysmal subarachnoid hemorrhage (SAH)
- 3. Hemorrhagic infarction
- 4. Sinovenous occlusion
- 5. Subdural hematomas
- 6. Thrombolytic related.

**II. CLINICAL SYNDROMES**

A. Clinical Manifestations of the More Common Clinical Syndromes of Ischemic Stroke

- 1. Carotid artery occlusion
- 2. MCA, complete territory
- 3. MCA, superior division
- 4. MCA, inferior division

5. Striatocapsular infarction
6. “Watershed” infarctions, anterior and posterior
7. Basilar artery thrombotic and embolic syndromes.
8. Basilar branch occlusion
9. Vertebral occlusive disease
10. Thalamic syndromes
11. Classic lacunar syndromes
12. Major neurobehavioral syndromes of the right and left hemispheres
13. Major neurobehavioral syndromes of the posterior cerebral artery territory

B. Transient ischemic attack

### III. DIAGNOSIS

A. Evaluation of stroke patients.

1. Brain imaging
2. Other diagnostic tests: EEG, CSF
3. Arterial imaging
4. Cardiac imaging
5. Hematologic tests.

B. Neuroradiology

1. Radiographic signs of acute and chronic ischemic and hemorrhagic stroke.
2. Indications, contraindications, and cost considerations for the use of specific neuroradiographic studies.

C. Neurosonology

1. Principles and interpretation of vascular ultrasound: Doppler principle, spectral analysis, B-mode imaging, color flow imaging
2. Carotid duplex
  - a. techniques to identify vessels
  - b. artifacts
  - c. principles of interpretation
  - d. indications and limitations
  - e. importance and method of establishing criteria for individual labs
3. Transcranial doppler
  - a. interpretation, indications, and limitations
  - b. bubble/echocontrast studies
  - c. diagnosis of vasospasm
  - d. diagnosis of intracranial occlusive disease

### IV. PATIENT MANAGEMENT

A Medical management of acute stroke

1. Management of blood pressure.
2. Fluids, nutrition.
3. Differential diagnosis in ED
4. Acute stroke scales.
5. Thrombolytic treatment: evaluation, delivery, management, complications.
6. Antithrombotic therapies.

7. Experimental therapies: blood flow and parenchymal agents.
8. Management of ICH, and indications for evacuation.
9. SAH
  - a. recognition and management of SAH and vasospasm
  - b. indications and timing of aneurysmectomy
  - c. interventional therapy
  - d. management of complications of SAH (eg., hydrocephalus)
10. Management of delayed complications, including cerebral edema and increased ICP.
11. Prevention of medical complications (e.g., DVT, infection, arrhythmias).

B. Surgical Treatment for Stroke and Stroke Prevention (basic understanding of possible indications and techniques)

1. Carotid endarterectomy
2. EC/IC Bypass
3. Hemicraniectomy
4. Resection of cerebellar infarction
5. Evacuation of ICH

C. Medical Therapies for Stroke Prevention

1. Antiplatelet agents: classes and clinical trial data
2. Anticoagulation: indication, controversies, administration, complications, and clinical trial data.
3. Management of risk factors.
  - a. Hypertension
  - b. Lipid disorders
4. Emerging risk factors
5. Stroke risk screening
6. Economics of stroke prevention therapies.

D. Interventional Neuroradiology

1. Endovascular therapy, basic understanding of indications, techniques and costs
  - a. percutaneous transluminal angioplasty
  - b. carotid stenting
  - c. intra-arterial thrombolysis
  - d. embolization of arteriovenous malformations and coiling of aneurysms
2. Radiosurgery for arteriovenous malformations

E. Rehabilitation of Stroke Patients

1. Matching patients' needs with appropriate rehabilitation services
2. Outcome measurements
  - a. familiarity with scales (eg , NIH Stroke Scale, Barthel Index, Rankin Scale, Glasgow Outcome Scale, Functional Independence Measure)
3. General principles of acute and longer term stroke rehabilitation
4. Rehabilitation issues of depression, spasticity, pain.

5. Neurobehavioral issues, including aphasias and "nondominant hemisphere" syndromes.
  - a. Vascular dementia: basic understanding of pathogenesis, assessment, diagnostic criteria, risk factors, prevention and treatment.
6. Transition to the community and continuity of care

## **V. EPIDEMIOLOGY**

- A. Economics of stroke.
  1. ICD and CPT codes
- B. Genetics of stroke.
- C. Understanding of Relative Risk, Odds Ratio, Attributable Risk, Prevalence Rate, Incidence Rate, Case Control Study, Cohort Study, Absolute/Relative Benefit, Risk Reduction, Number Needed to Treat

## **VI. Clinical research**

- A. Clinical Trials
  1. Concepts of randomization, blinding, controls, follow-up period, adverse events, FDA regulations, primary outcomes events
  2. Familiarity with seminal reports/studies of thrombolytic agents, antiplatelet agents, anticoagulants, carotid endarterectomy, and other key medical or surgical therapies.

## **VI. EDUCATION/PUBLIC POLICY**

- A. Importance of Teaching the Public and Healthcare Providers about Recognition and Control of Stroke Risk Factors and the Recognition of the Warning Signs of Stroke
- B. Components of a Stroke Center and a Stroke Team
- C. Familiarity with Goals and Activities of the American Heart Association Stroke Council and the National Stroke Association
- D. Advocation for Cost Effective "Mass" and "High Risk" Strategies for Stroke Prevention in the Public Health Policy Arena.