Cerebrovascular Disease

Biomedical Engineering - URJC

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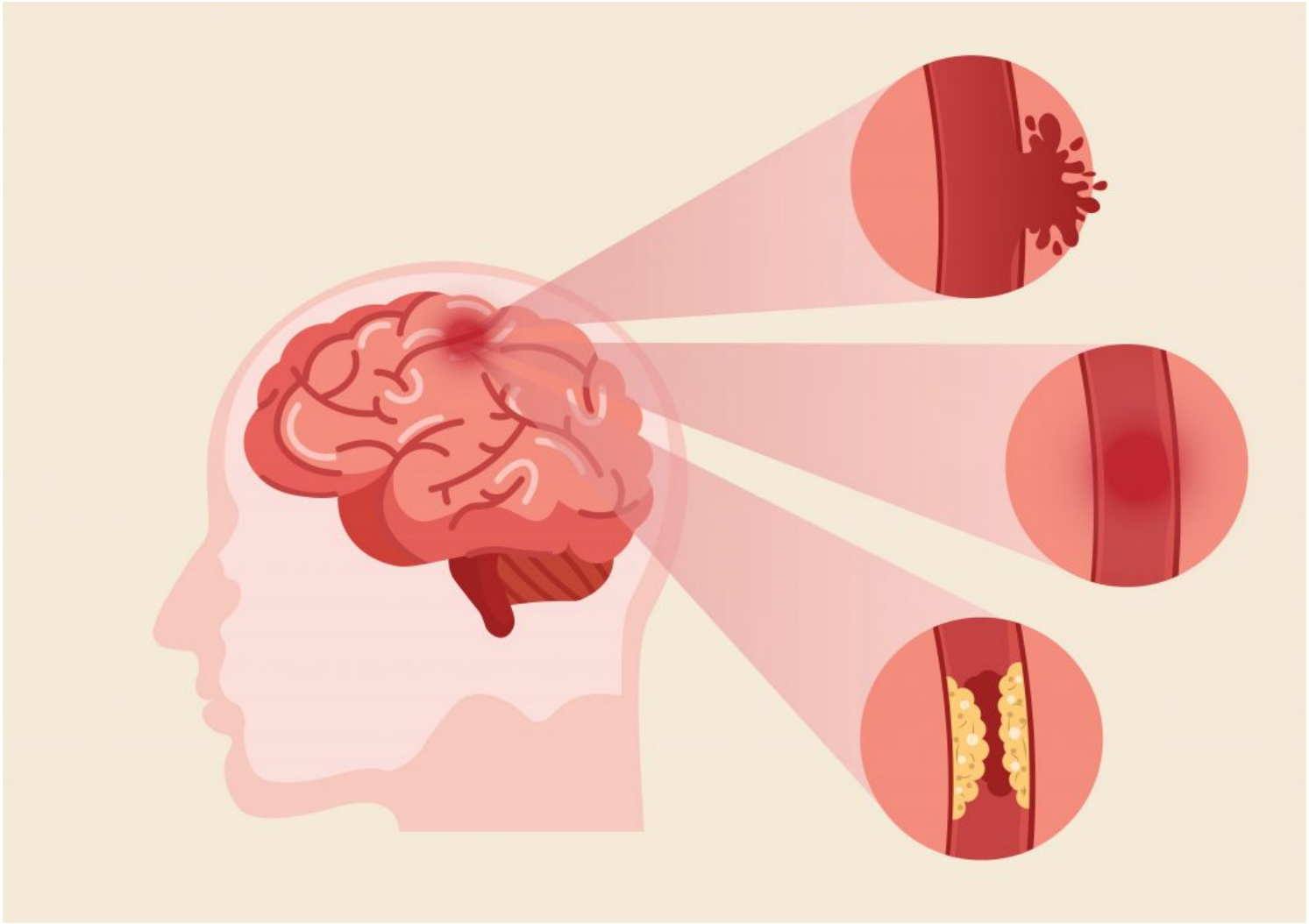
Cerebrovascular Disease Overview

Ictus

- A stroke, or cerebrovascular accident, is an emergency medical condition.
- Acute compromise of cerebral perfusion or vasculature (**clot**, **embolus**, bleeding).

Introduction



Introduction

- Stroke is the leading cause of adult disability worldwide.
- Critical to recognize and treat early.
- Approximately 80 % of strokes are **ischemic** (and rest are **hemorrhagic**).
- Causes include hypertension, clotting disorders, carotid dissection, and drug abuse.

Etiology

Etiology

- **Ischemic stroke** (80 %) – cessation of arterial flow.
- **Hemorrhagic stroke** (20 %) – bleeding into the brain rupture of a vessel.
- Common risk factors: hypertension, diabetes, smoking, obesity, drug use.

NOTE: An ischemic stroke can evolve to a hemorrhagic stroke

Etiology

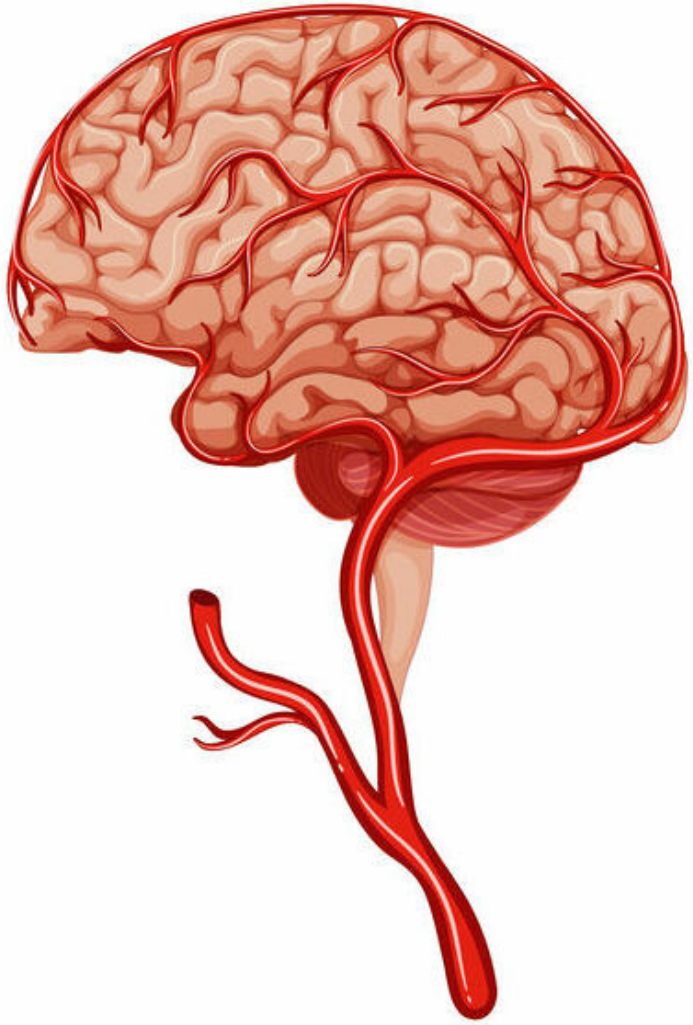
Ischemic strokes

1. Embolic (*travelling clot*)
2. Thrombotic or atherosclerotic (clot *in situ*)
3. Lacunar

Causes of ischemic strokes

- **Hypertension**, smoking
- Diabetes, obesity
- Drug abuse

Etiology



hemorrhagic

embolic

atherosclerosis

Etiology

Hemorrhagic strokes

- Rupture of the vessel (usually arteries)
- 20 % of all strokes
- Bad prognosis if acute (high mortality rate)

Causes of ischemic strokes

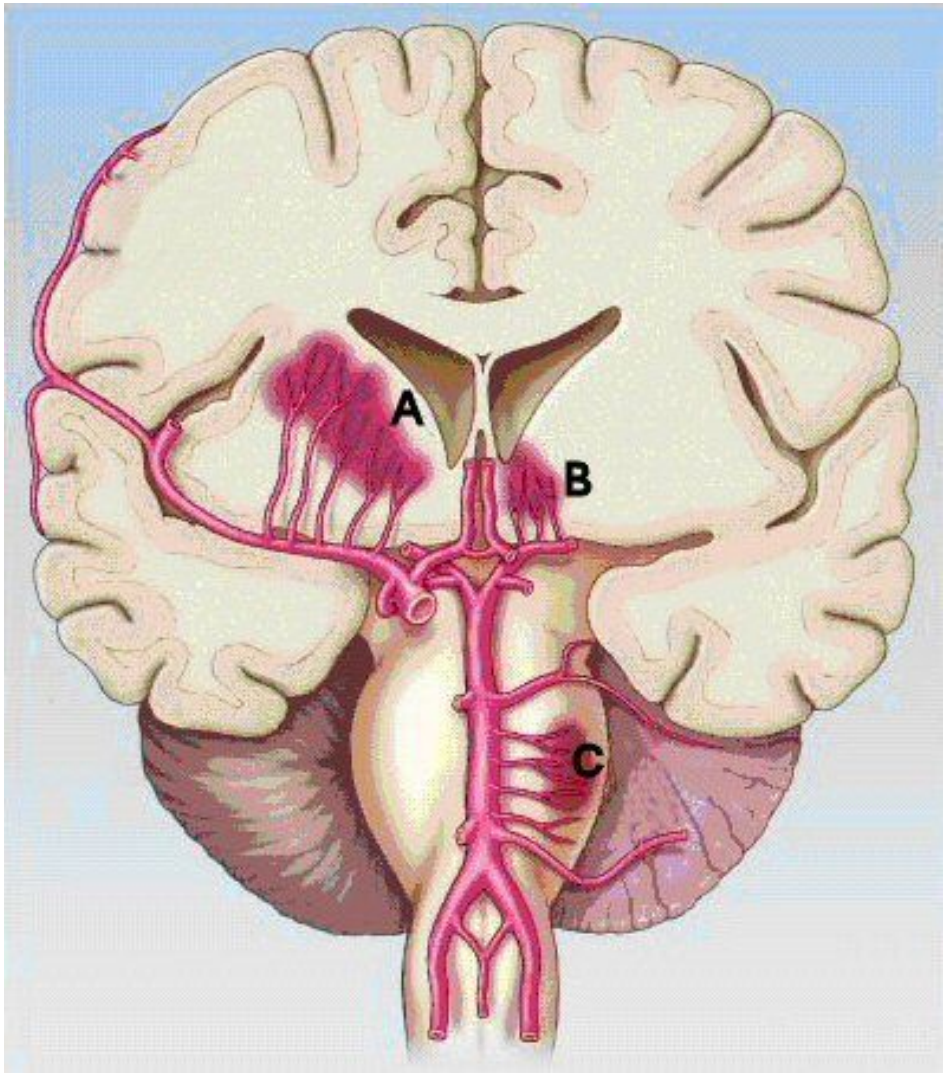
- **Hypertension**, aneurysm rupture, arteriovenous malformations
- Venous angiomas, bleeding due to illicit drugs (like cocaine)
- Hemorrhagic metastasis, amyloid angiopathy

Etiology

Lacunar strokes

- Type of an ischemic strokes
- Occlusion of the small penetrating branches of the cerebral arteries
- Causes: microemboli, arteriosclerosis

Etiology

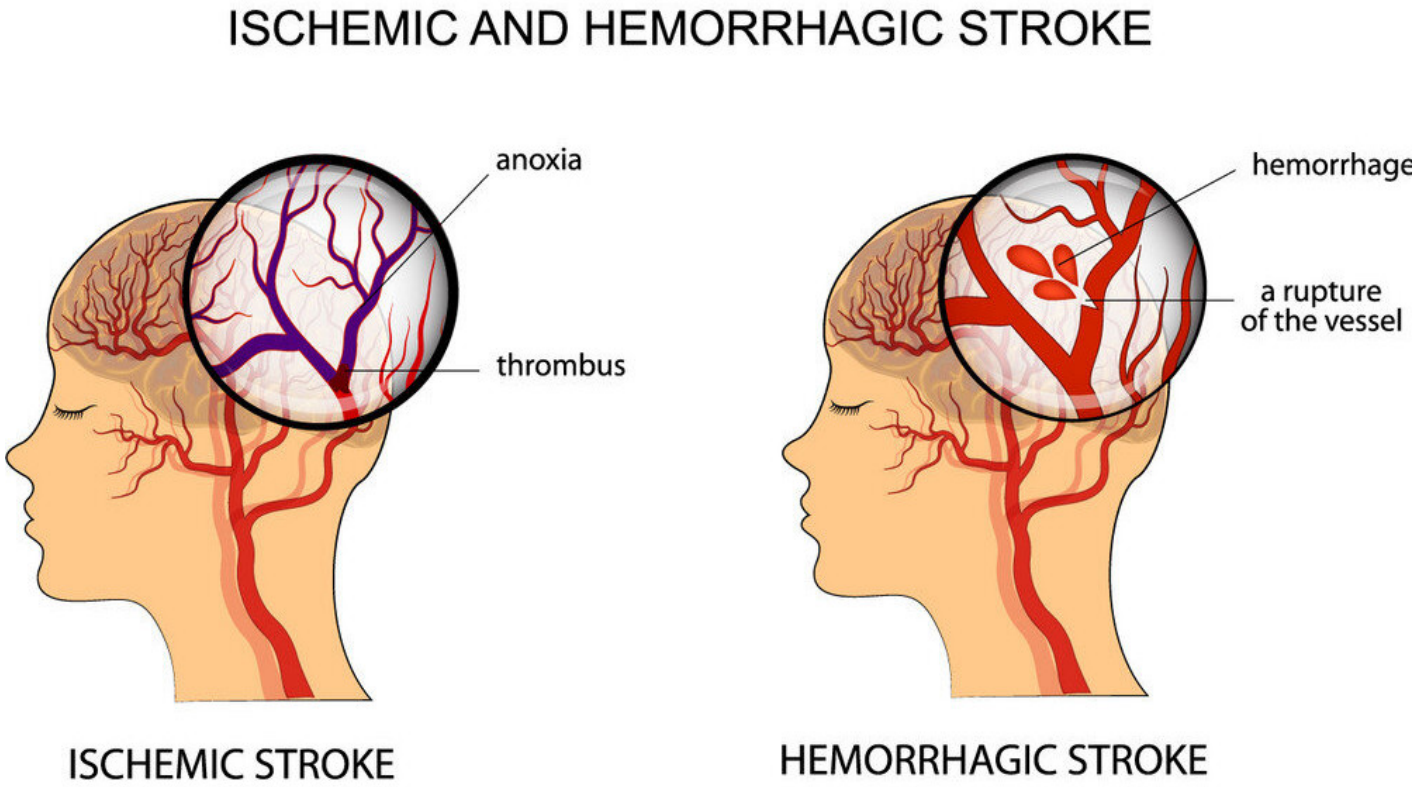


Pathophysiology

What happens in a stroke?

- Stroke results from **sudden** ischemia or bleeding in an area of the brain.
- Ischemic damages
- Artery rupture: the hematoma disrupts the neurons and glia. The primary injury is due to the compression of brain tissue by the hematoma and an increase in the intracranial pressure.
- Both cases: inflammation, swelling, edema, overproduction of free radicals, cytotoxicity, and cellular death.

Pathophysiology

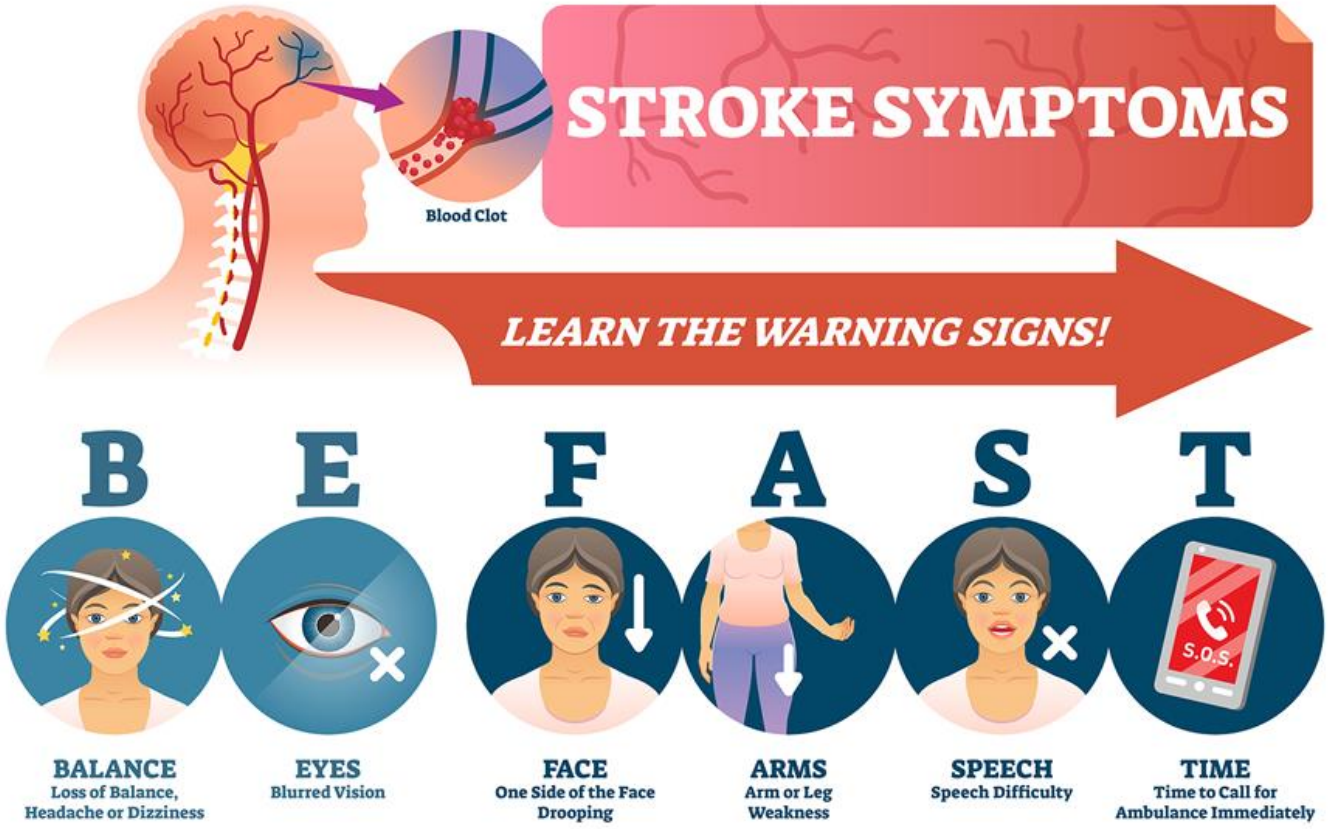


Clinical Presentation

Symptoms of a stroke

- **Overall** symptoms involve: visual function, level of consciousness, motor function, cerebellar dysfunction, language dysfunction.
- Common presentation (**neurological deficits**): headache, **aphasia**, **hemiparesis**, **facial palsy**.
- Acute onset: vomiting, neck stiffness, and the **rapidly developing neurological signs** (a stroke is usually acute and progressing).
- Recognizing stroke syndromes.

Clinical Presentation



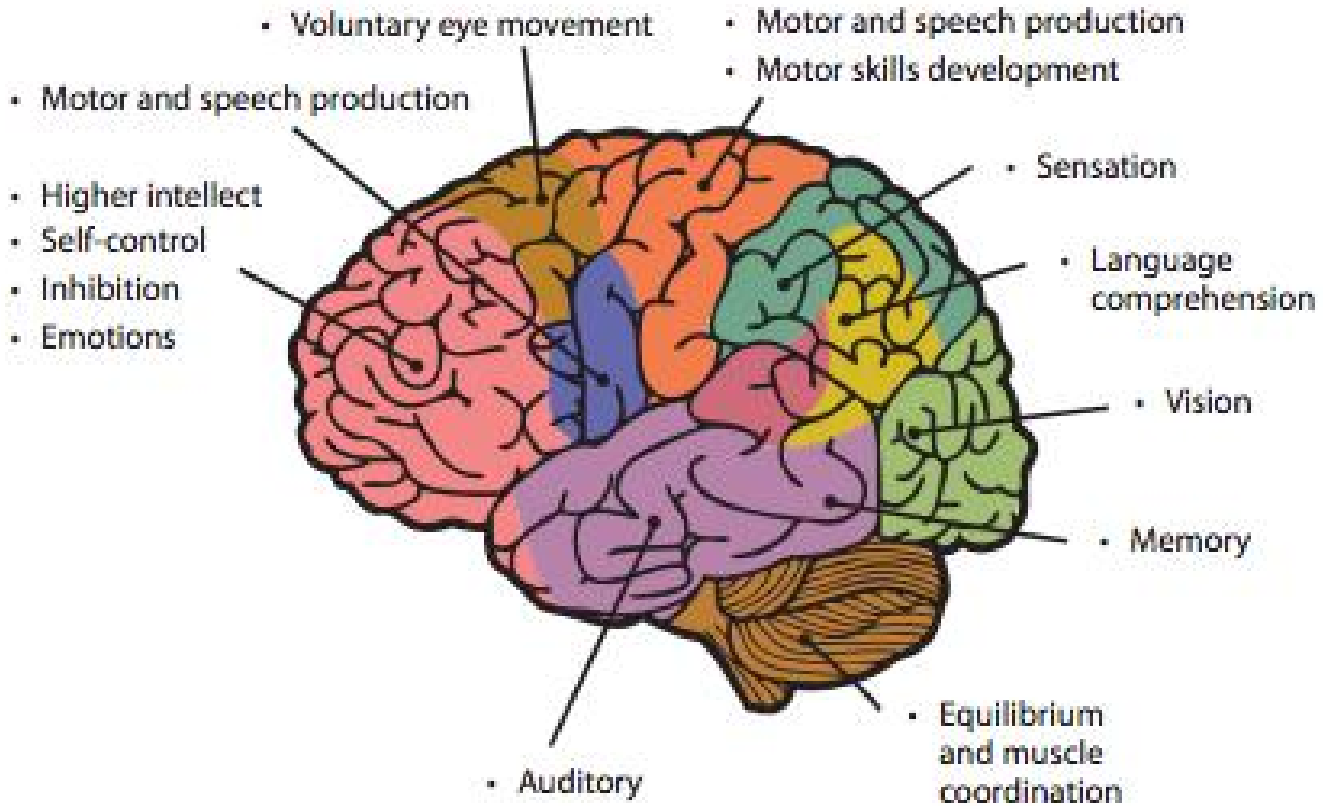
Stroke Syndromes

1. Anterior Cerebral Artery Infarction
2. Middle Cerebral Artery Infarction
3. Posterior Cerebral Artery Infarction
4. Cerebellar Infarction
5. Lacunar Strokes

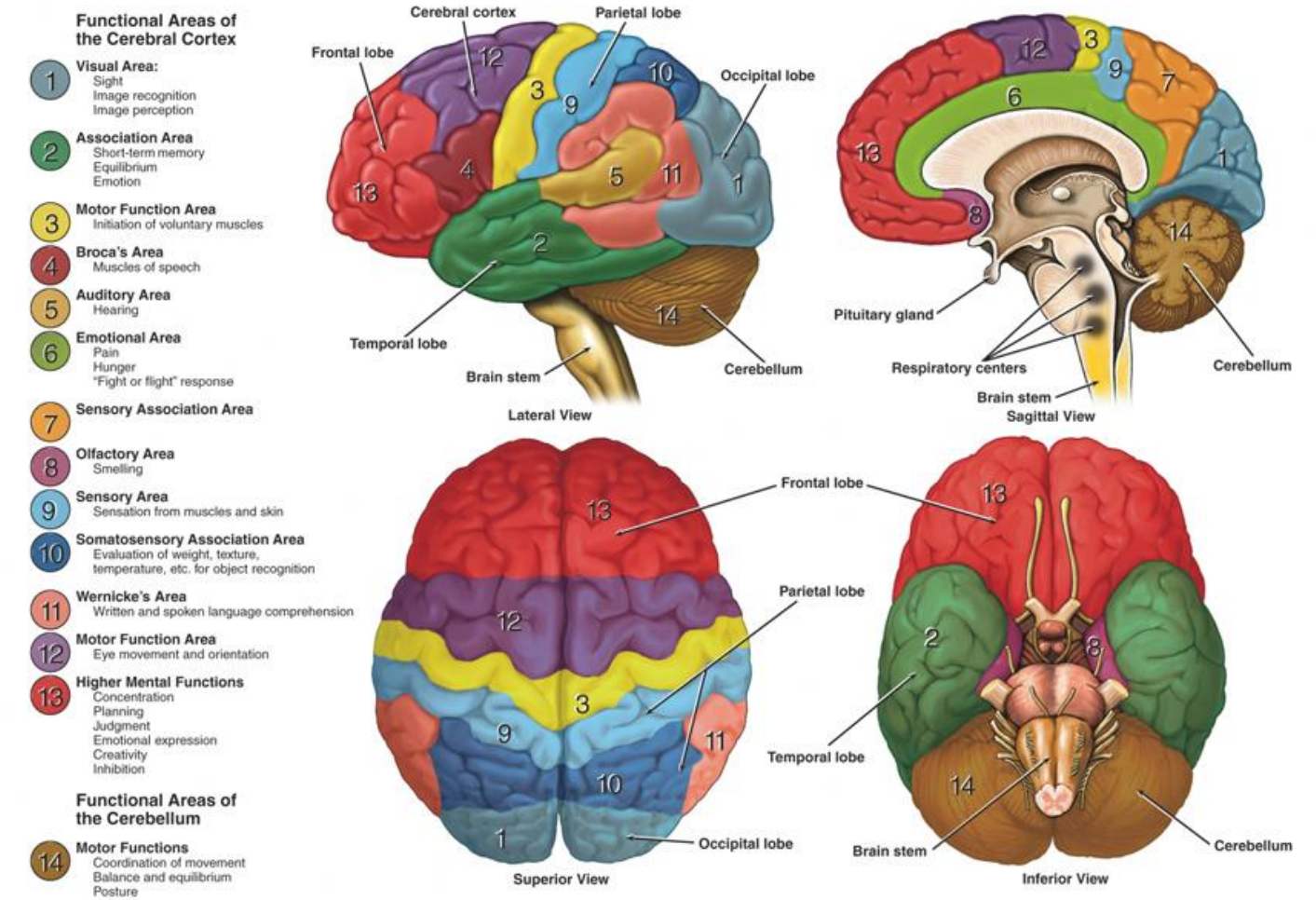
Clinical Presentation

Functional areas of the brain

This illustration shows the brain's functional areas. After a stroke, deficits in function depend on which cerebral artery is affected.



Clinical Presentation



Transient Ischemic Attack (TIA)

TIAs

- **Transient** episode of neurologic dysfunction.
- Considered a warning for an impending ischemic stroke.
- A TIA typically lasts **less than an hour**.
- Urgent evaluation needed.
- Maximum risk in the first 48 hours.

Diagnosis and Evaluation

- Stabilize ABC – Airway, Breathing, Circulation.
- Rapid history, physical exam, blood samples.
- Non-contrasted head CT or CT Angiography for diagnosis.
- It is key to determine whether the stroke is **ischemic** or **hemorrhagic** to choose the proper therapy and management.

Treatment

- Admission for neurological workup (better in a **Stroke Unit**).
- Fibrinolytic therapy (Alteplase) within 4.5 hours for **ischemic stroke**.
- Endovascular intervention for large vessel occlusions.

Complications and Support Management

Complications of fibrinolytic therapy

1. Hemorrhagic transformation, which leads to...
2. hemorrhagic infarction, which leads to...
3. parenchymal hematoma

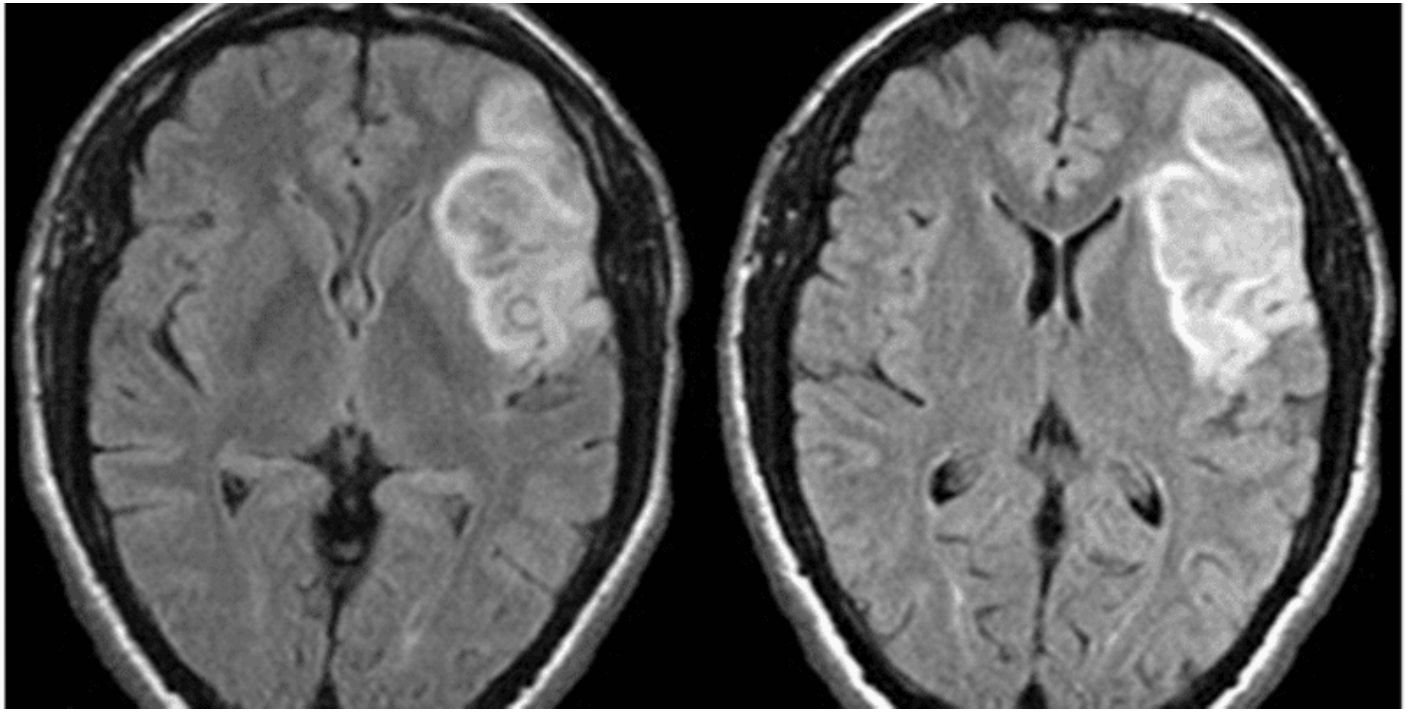
Ischemic Stroke Treatment

- Assessment of the hemorrhagic transformation risk.
- Aspirin within 24-48 hours.
- Support includes oxygen, glucose management, diuretics, seizure management.

Hemorrhagic Stroke Treatment

- Blood pressure management.
- Hemostatic therapy to reduce hematoma progression.
- Surgical treatments: craniotomy, decompressive craniectomy, aspiration.

Clinical Presentation



Clinical Presentation