Neurologic emergencies

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Signs and symptoms that constitute a neurologic emergency

- Worsening and changing neurologic signs
- Abnormal consciousness
- Seizure
- Severe, unexpected headache
- Acute cranial nerve deficit
- Inability to stand or walk

The role of physician in neurologic emergency

The primary goal:

to preserve patients life by maintaining his respiration and circulation

The subsequent goal:

to maintain patients brain, spinal cord and nerves in maximum possible health until definitive diagnosis and treatment have been achieved

Principle 1

An injury of the nervous system does not cause instantaneous organ death.

In any type of injury to the nervous system the process of injury is a dynamic and continuing one. There remain tissue and function that may be saved. The task for clinician is

- to aggressively arrest the primary process
- to preserve the surviving but dysfunctional tissue
- to prevent or reverse any secondary events that may cause further nervous system damage

Pathophysiology of nervous system damage

Pathologic events	Common cause	Outcome
Cell death	Anoxia Hemorrhage, ischemia, trauma, hypoglycemia	No recovery
Axonal or myelin disruption	Trauma Multiple sclerosis Transverse myelitis Tumors	Partial recovery, if damage not severe
Interruption of transmission	Toxins Metabolic disorders Spinal cord or nerve compression	Full recovery when primary lesion is treated

Pathophysiology of nervous system damage

Secondary pathologic events	Common cause	Outcome
Edema Increased ICP Obstruction of CSF flow Vasospasm Failure of autoregulation Failure of collateral vascular supply Altered respiratory function Altered cardiac function	Anoxia Intracranial hemorrhage Ischemia Trauma Tumors	Can be prevented or reversed with some recovery

Principle 2

Stabilization of vital functions - ABC

- Airway – always consider the need for intubation. If in doubt, intubate

  coma - hypoventilation, post-ictal apnoe,

  Intracranial hemorrhage – pulmonary edema

  Most common mode of death in brain-damaged patients is respiratory arrest

- Stop bleeding
- Maintain systemic circulation

  spinal cord injury – peripheral vascular shock

  ↑ICP – systemic hypertension

Principle 3

Is disease structural or non-structural

- Structural lesions
  - focal, i.e. localized to one area or side
  - „mass effect“, increased ICP
  - brain tumors, abscesses, hematomas, cerebral infarctions

- Non-structural lesions
  - diffuse damage
  - metabolic a toxic disorders, meningoencephalitis, multiple sclerosis

Principle 4

Keep the diagnosis simple, and don't initially worry about detailed localization of the lesion

- The patients state of consciousness
- The presence or absence of focal signs
- The speed of onset of the symptoms

Initial diagnosis

Level of consciousness	Focal signs	Onset	Common causes
alert	-	acute	TIA, seizure, migraine, concussion, anxiety symptoms, cardiovascular events - syncope,
	+	acute	Ischemic stroke trauma (spinal cord, nerve)
	+	subacute	Multiple sclerosis Metastatic tumors
	+	chronic	primary tumors (glioma, meningioma)

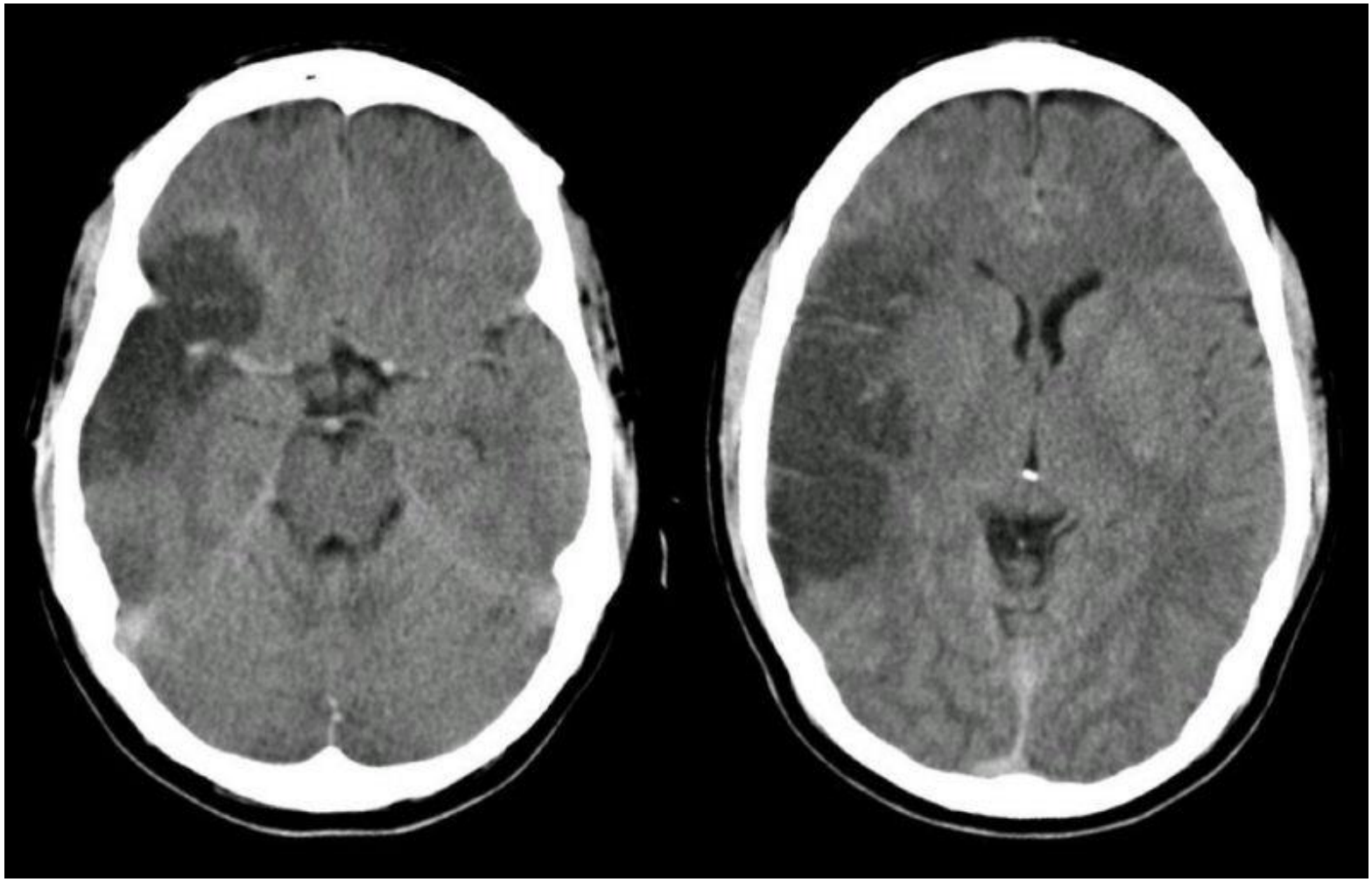
Initial diagnosis

Level of consciousness	Focal signs	Onset	Common causes
depressed	-	acute	Drug overdose, hypoglycemia, post-ictal state, meningitis, SAH, cardiac arrest, concussion
	+	acute	Hemorrhage, contusion, large or bilateral infarcts, brainstem infarcts, hypoglycemia
	Ataxia only	subacute	Drugs
	+	subacute	Abscess, subdural hematoma, metastatic tumor, herpes encephalitis
	+	chronic	Primary tumor, subdural hematoma

Common emergency syndromes

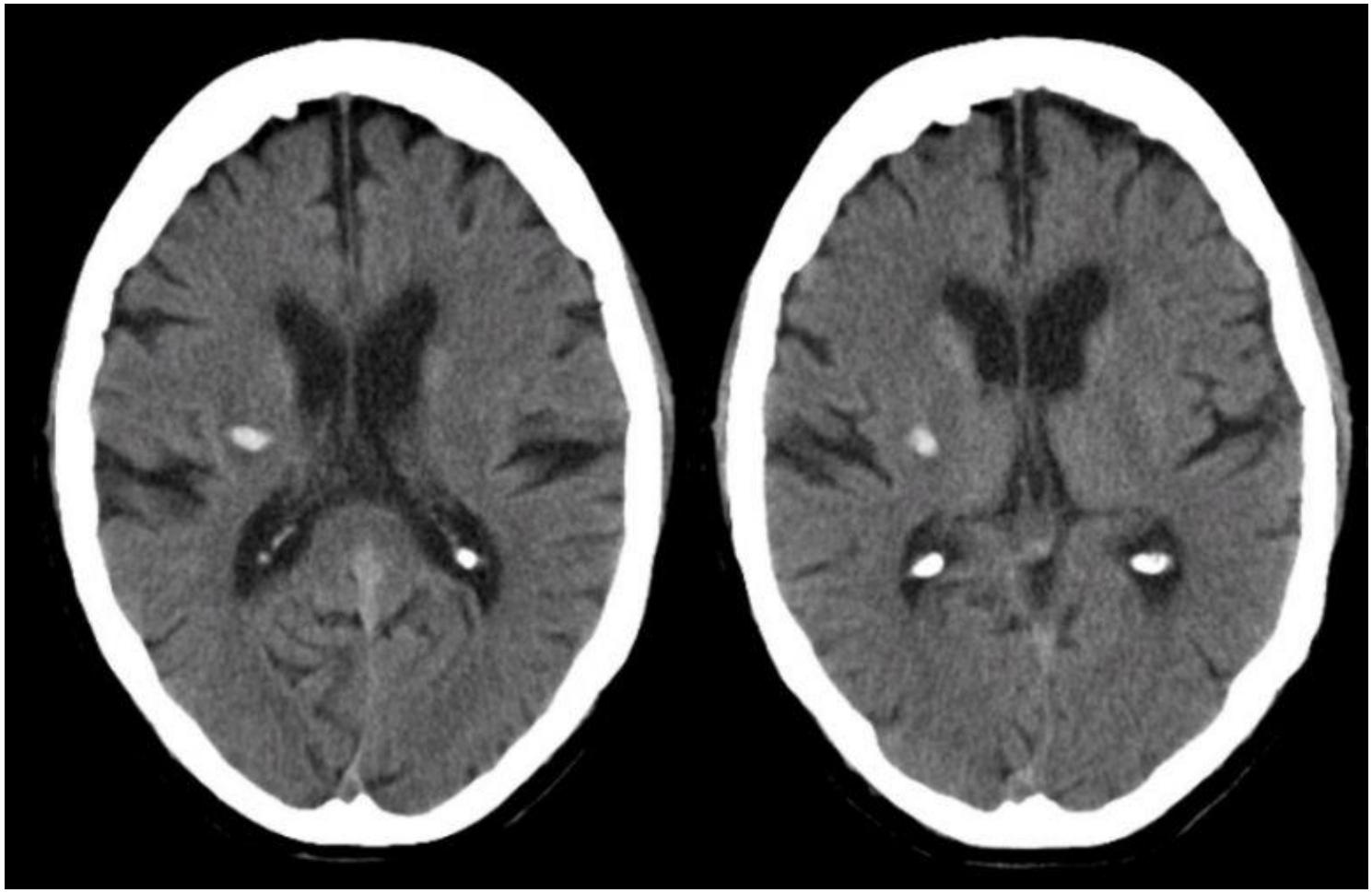
Syndrome	Onset	Probable diagnosis	Diagnosis to exclude	Best tests
Alert with hemiparesis	Acute	Ischemic stroke, TIA	Small hemorrhage, post-ictal after focal motor seizures	CT

Superior Division MCA Infarction



A 87 year old man with AF presented with sudden left side hemiparesis and eye bulbs deviation to the right.

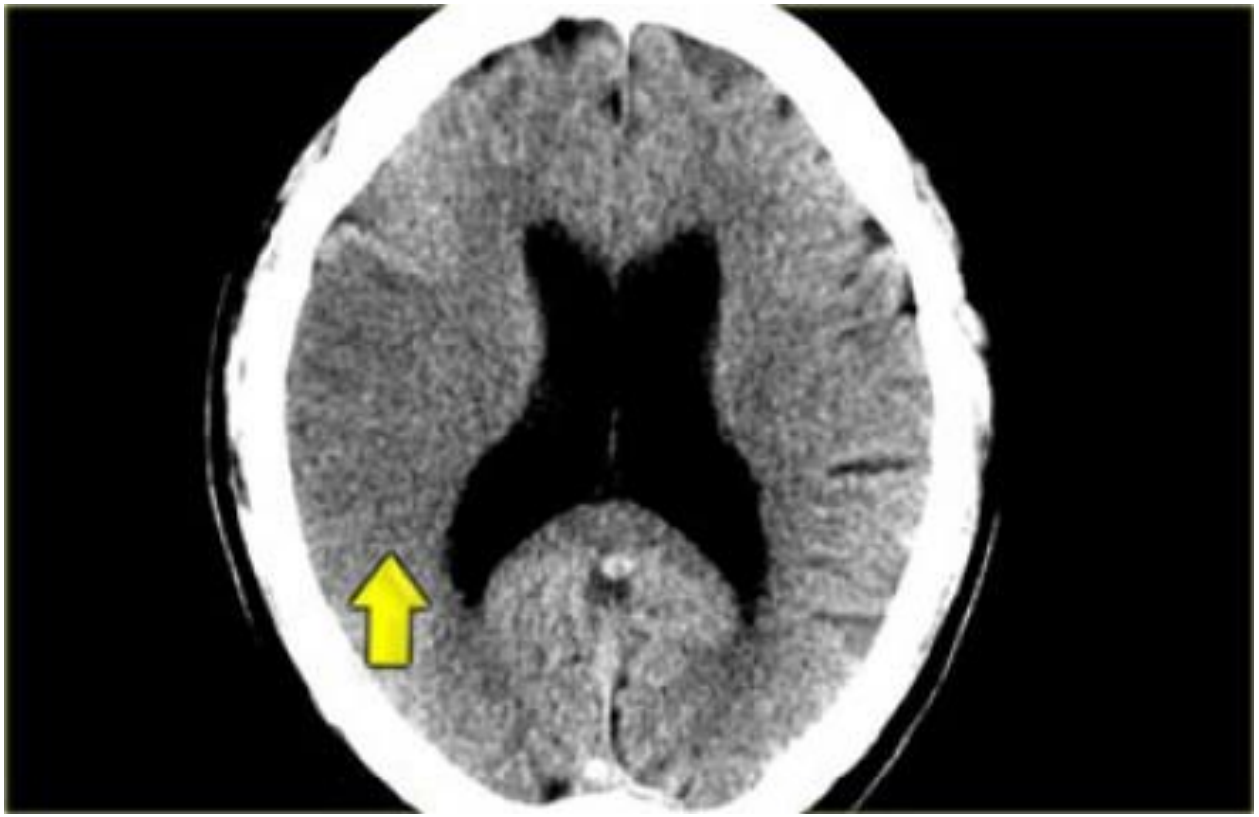
Small Basal Ganglia (Putamen/Internal Capsule) Intracerebral Hemorrhage



A 54 year-old man with a history of hypertension developed weakness affecting the left face, arm and leg

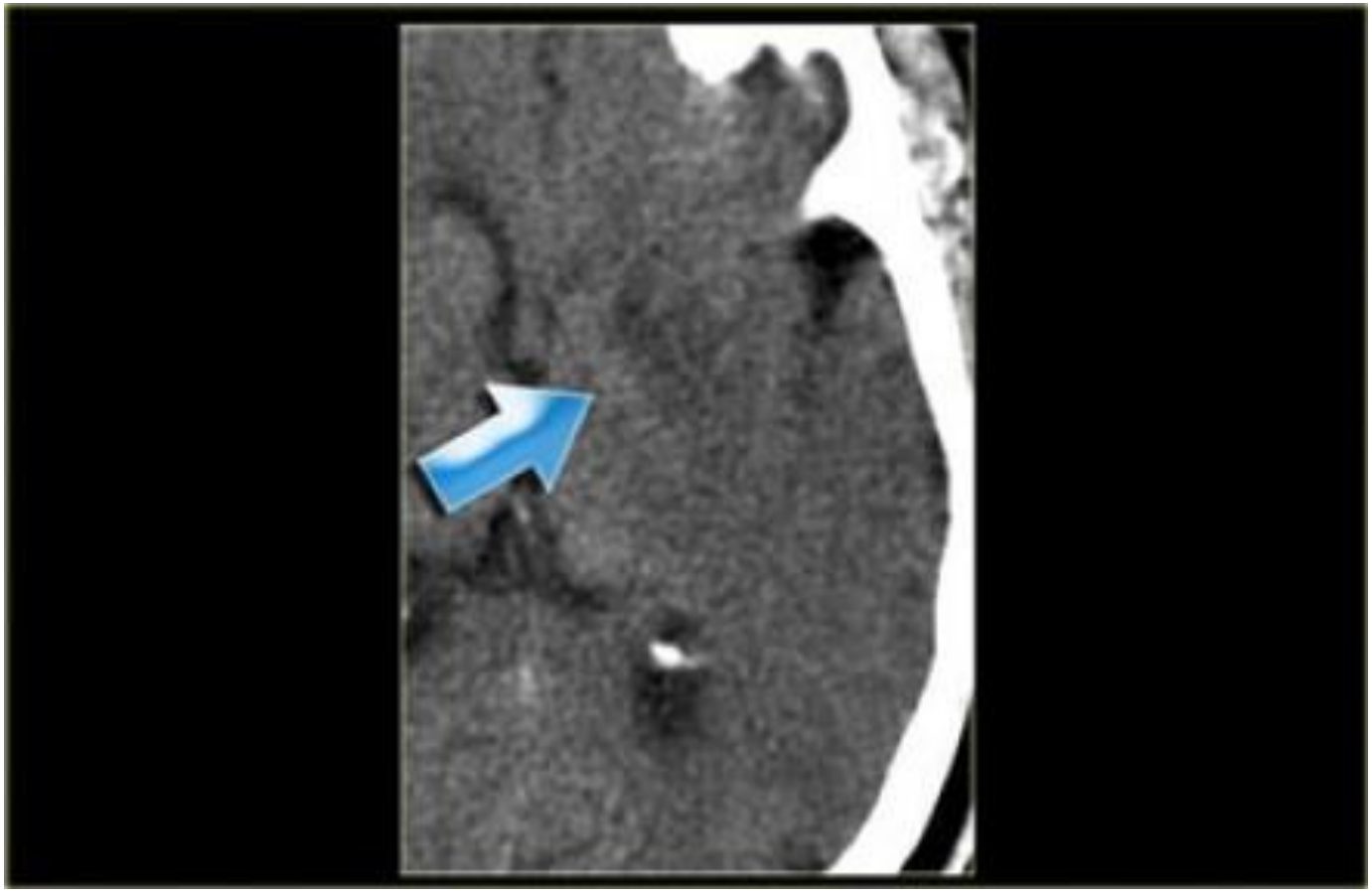
Early CT signs of cerebral ischemia

Hypoattenuating brain tissue in the right hemisphere



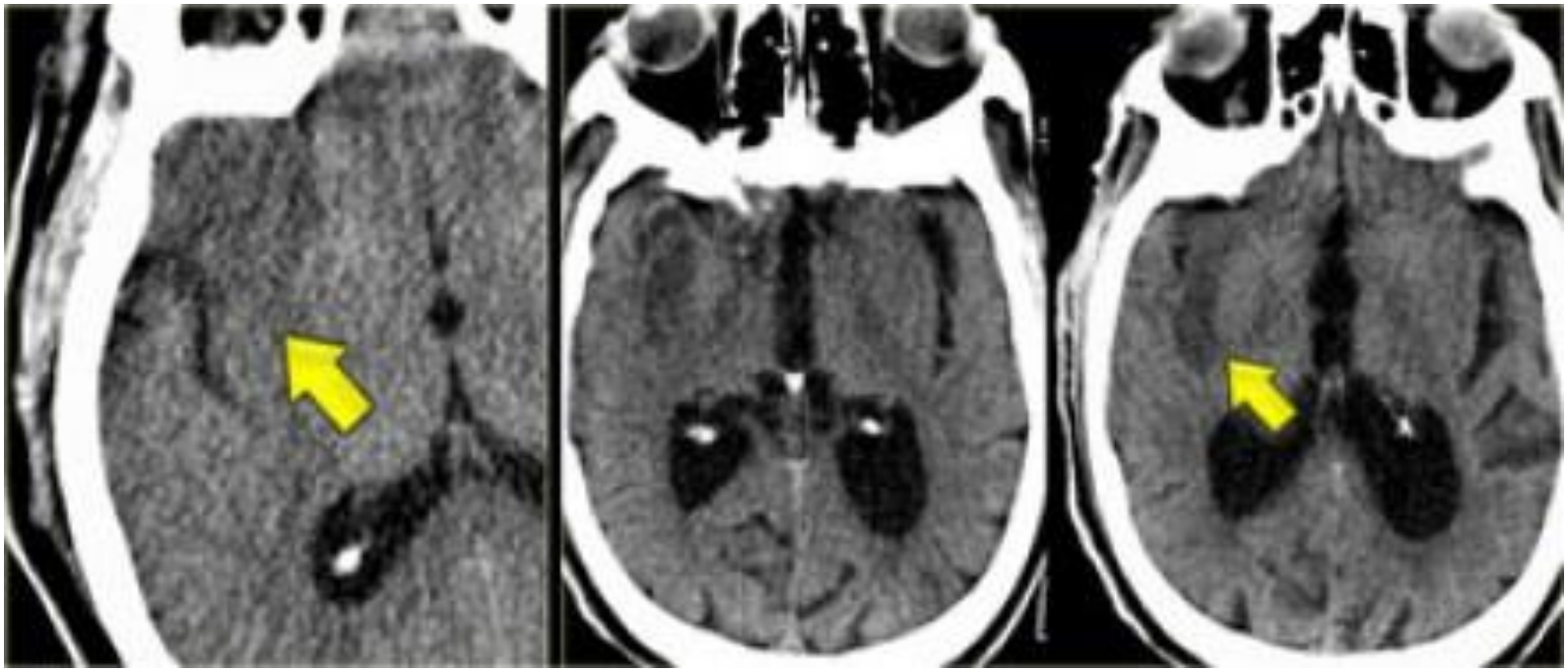
Early CT signs of cerebral ischemia

Obscuration of the lentiform nucleus



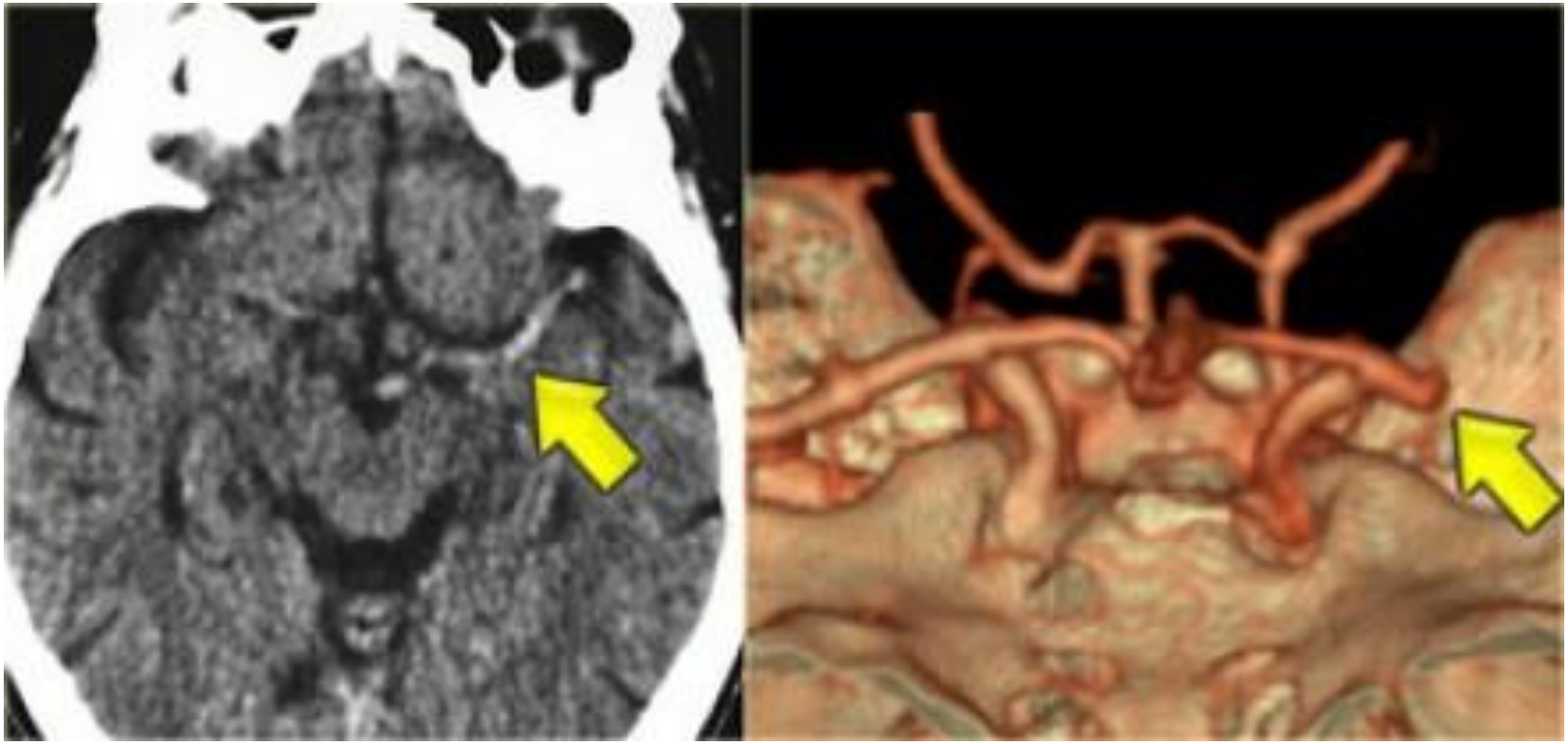
Early CT signs of cerebral ischemia

Insular Ribbon sign



Early CT signs of cerebral ischemia

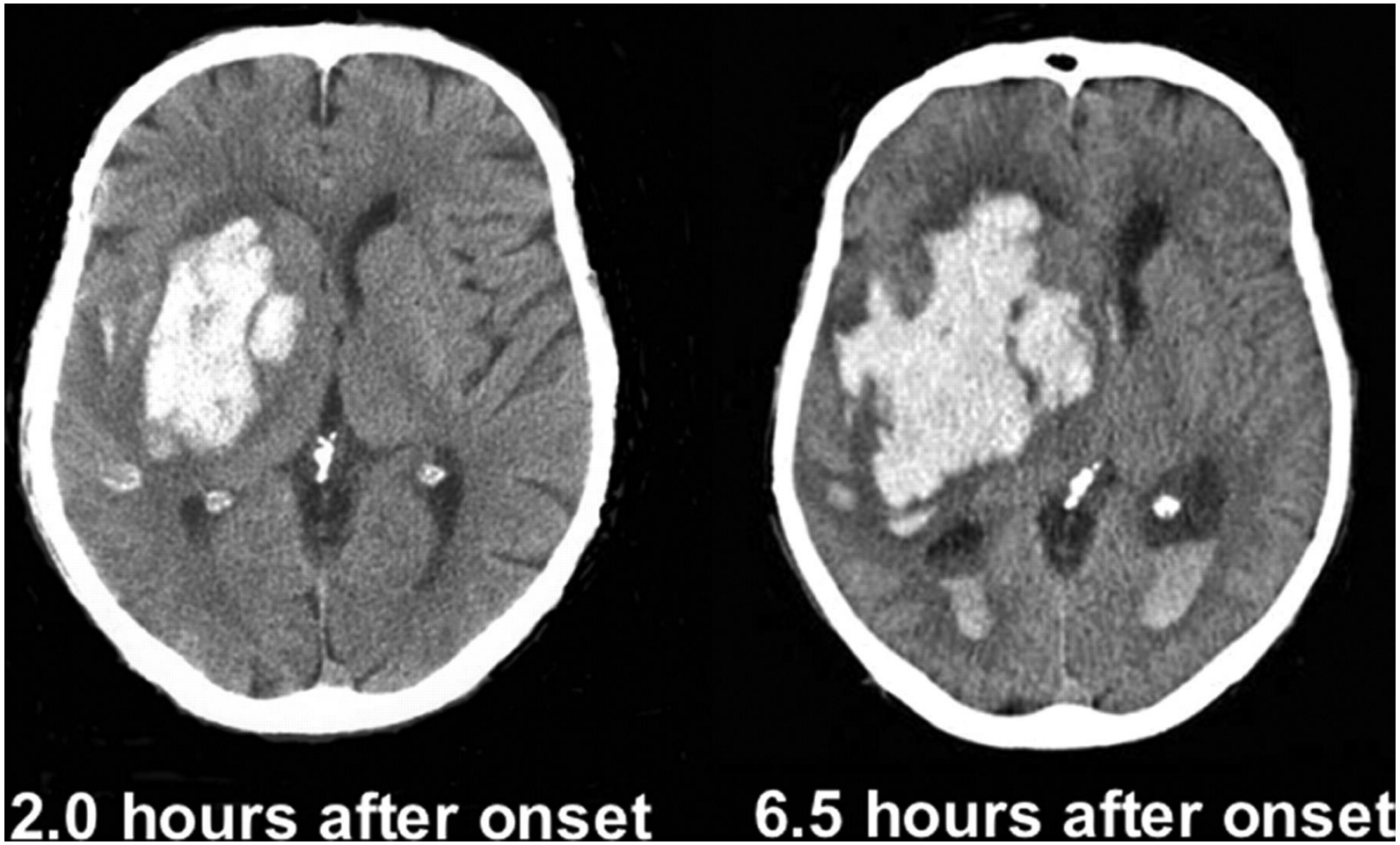
Dense MCA sign



Common emergency syndromes

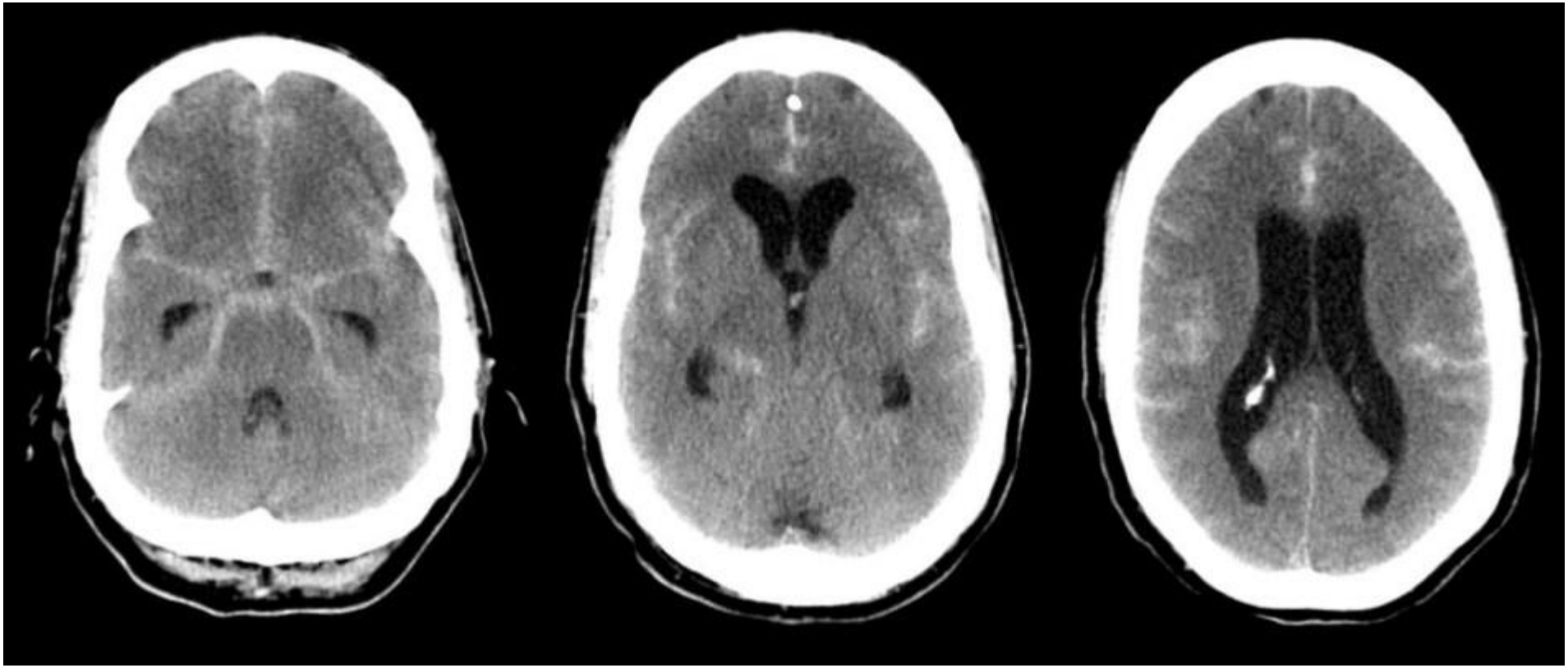
Syndrome	Onset	Probable diagnosis	Diagnosis to exclude	Best tests
Alert with hemiparesis	Acute	Ischemic stroke, TIA	Small hemorrhage, post-ictal after focal motor seizures	CT
Focal signs drowsy or comatose	Acute	Intracerebral or subarachnoid bleeding	Trauma, subdural hematoma, hypoglycemia	CT

Intracerebral hemorrhage



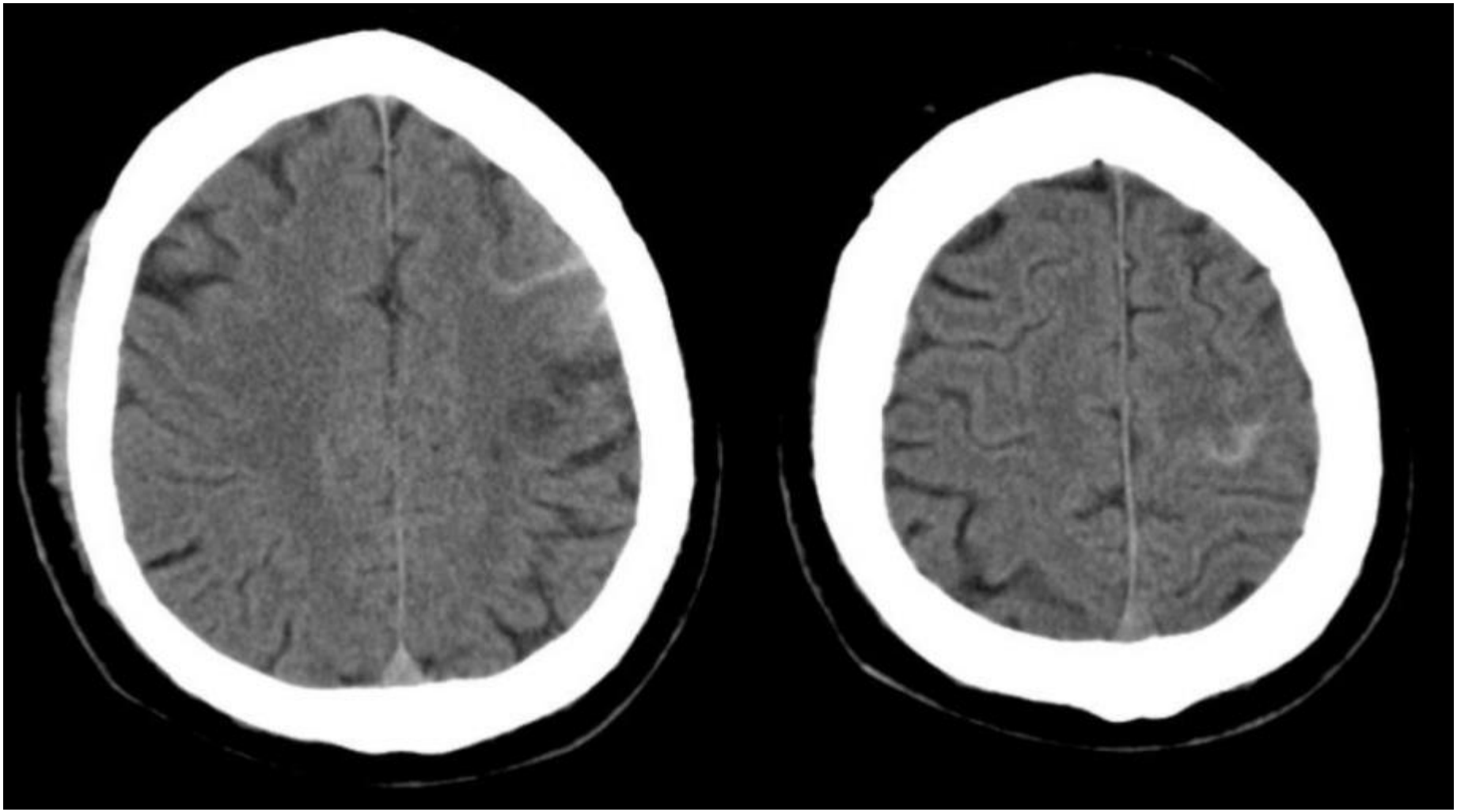
Early hematoma growth in a 48 year-old chronically hypertensive woman

Subarachnoid hemorrhage



37 years old women presented with explosive headache of sudden origin accompanied by nausea and vomitus

Subarachnoid hemorrhage



Common emergency syndromes

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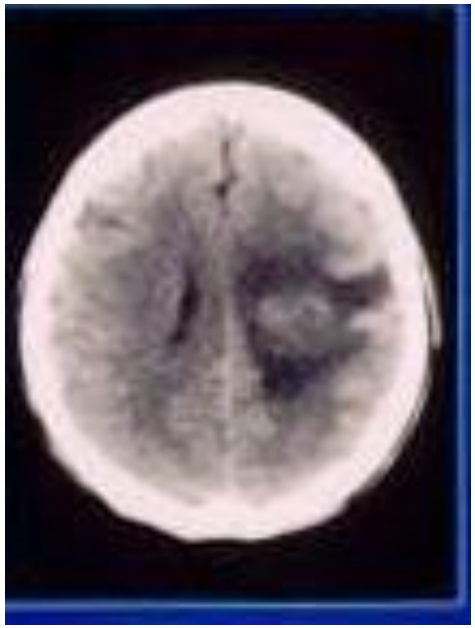
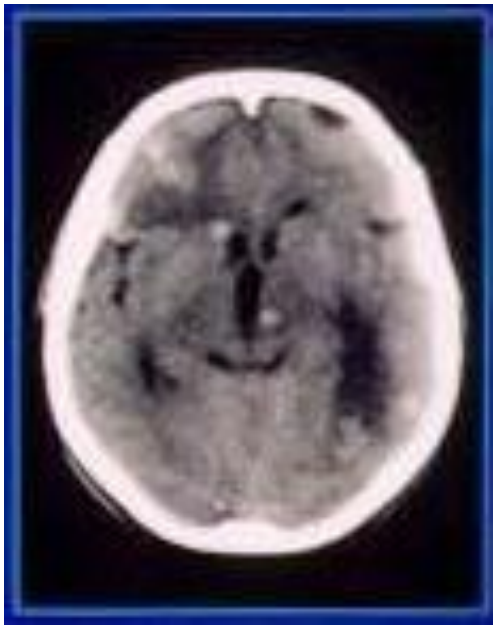
Focal signs drowsy or comatose	Acute	Intracerebral or subarachnoid bleeding	Trauma, subdural hematoma, hypoglycemia	CT
	Subacute or chronic	Tumor, abscess subdural hematoma	Herpetic encephalitis	CT (LP)

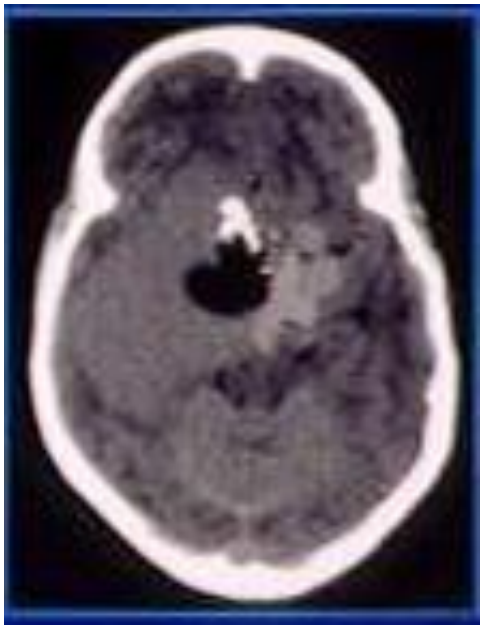
Brain tumors



Glioblastoma

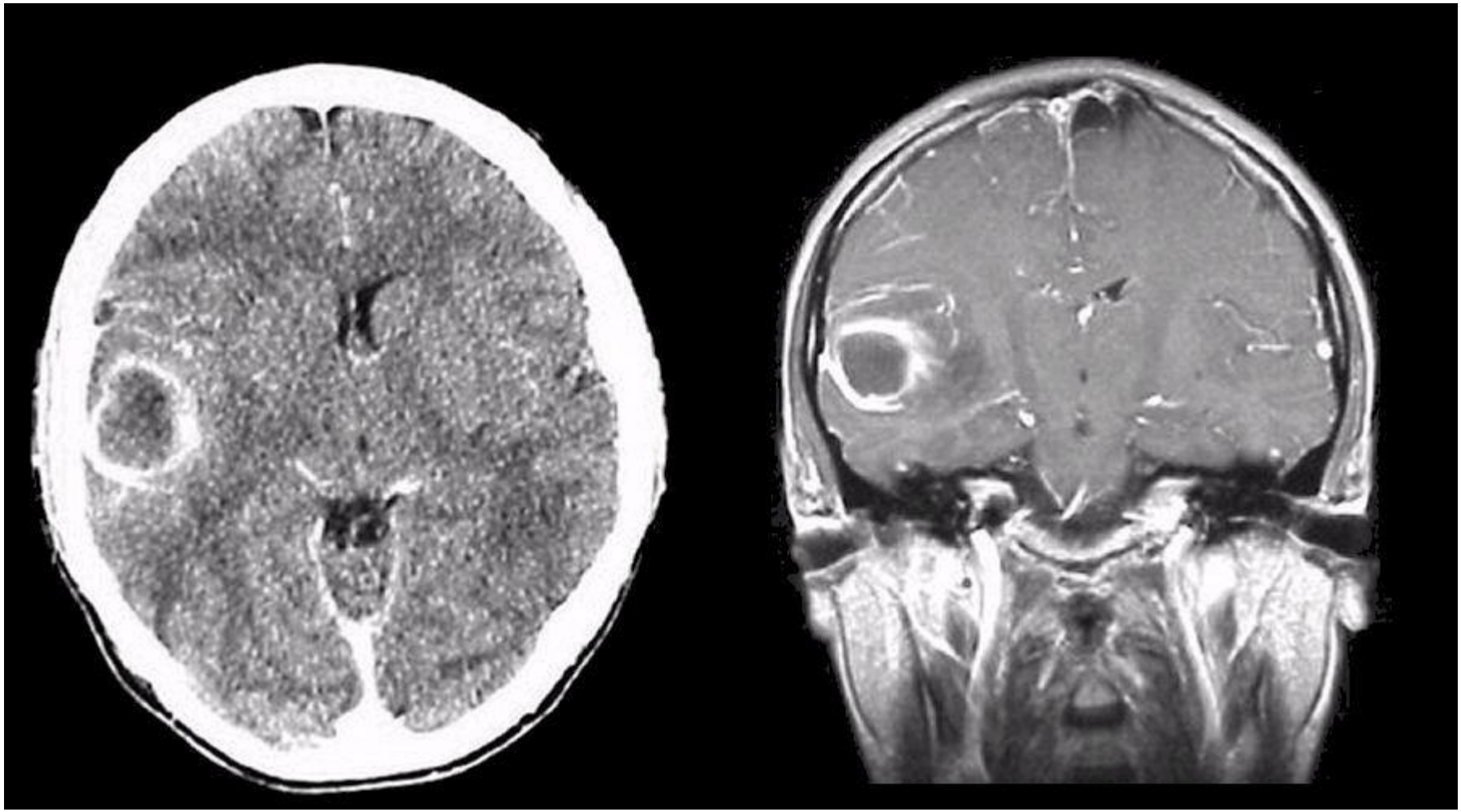


Metastases



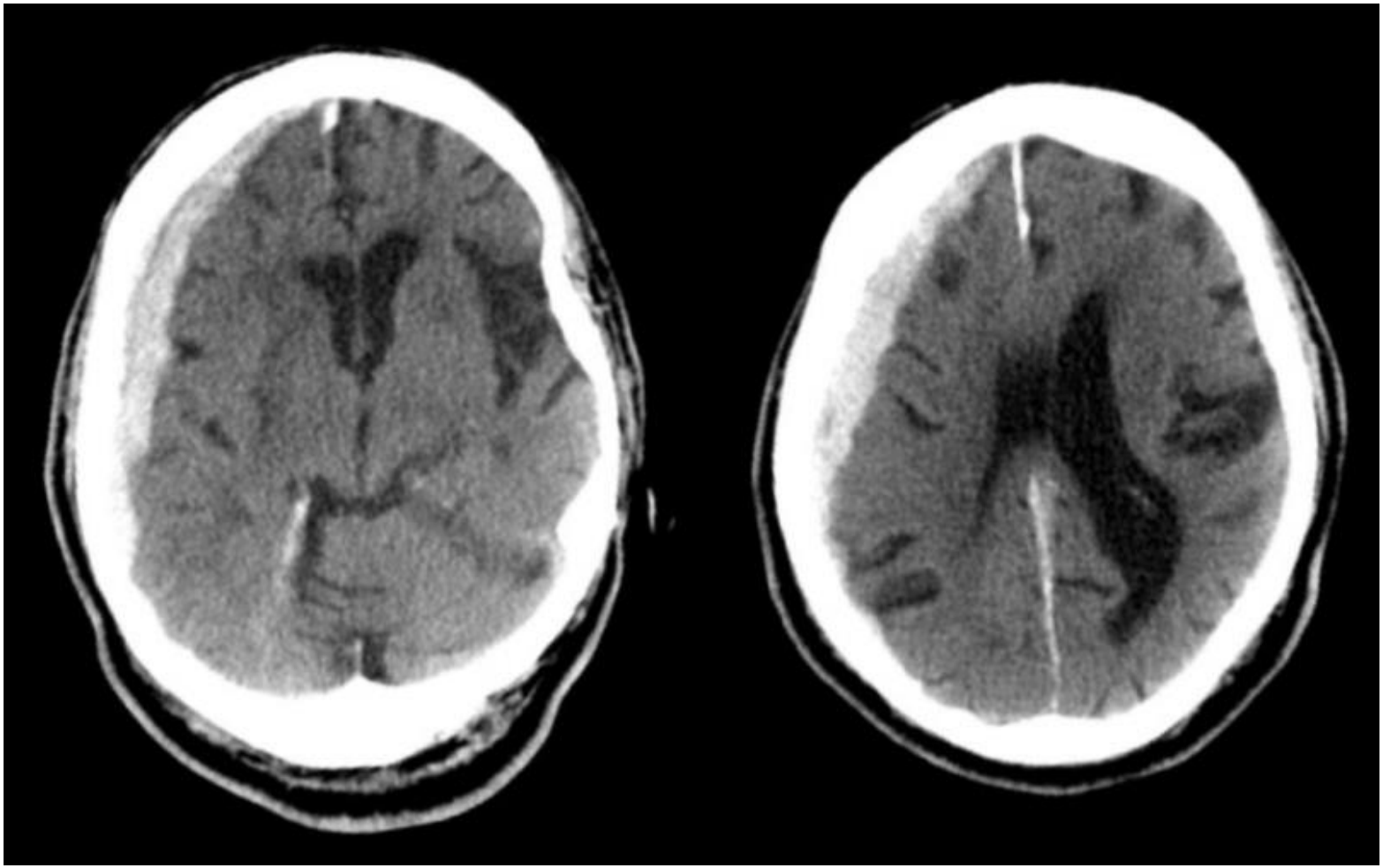
Cranio-pharyngioma

Brain abscess



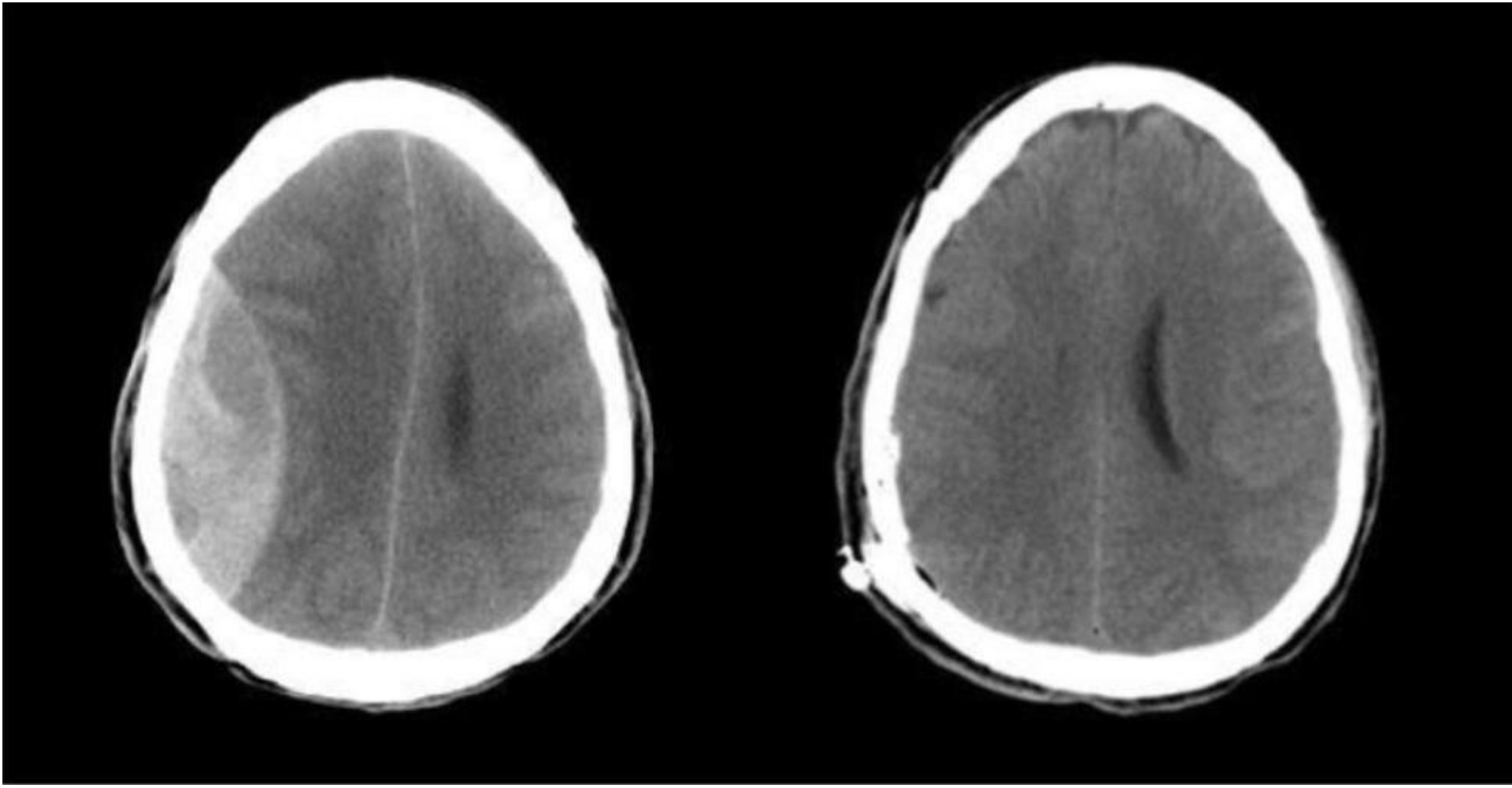
A 24 year-old woman presented with three days of increasing headaches followed by focal seizures.

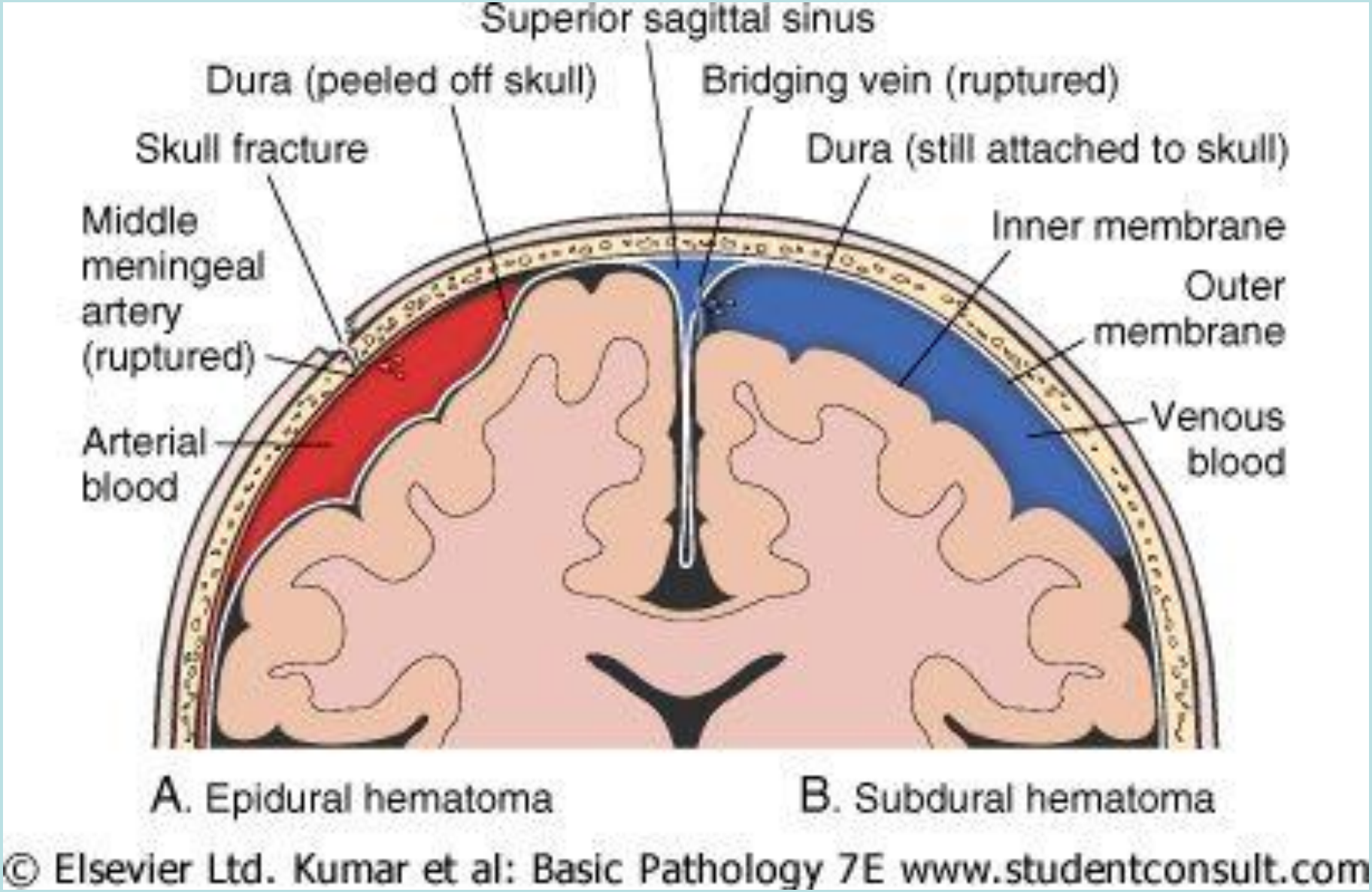
Subdural hematoma



A 72 year-old man developed a change in personality and mild weakness of the left arm and leg, which he denied.

Epidural hematoma

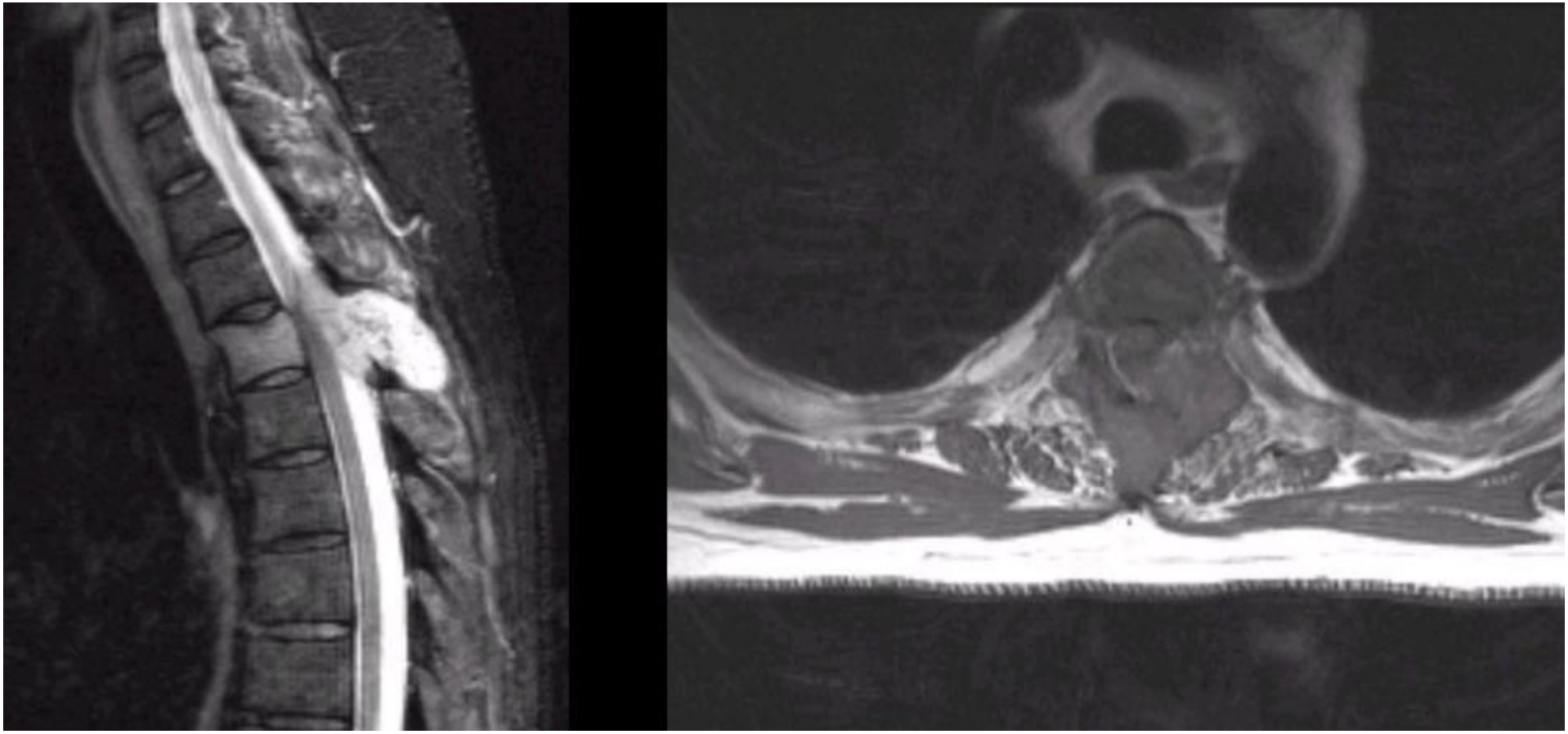




Common emergency syndromes

Syndrome	Onset	Probable diagnosis	Diagnosis to exclude	Best tests
Alert with paraparesis	subacute	Cord compression multiple sclerosis	Transverse myelitis, hydrocephalus myopathy, neuropathy	Myelography, CT
Alert with ataxia	acute	Cerebellar infarct or hemorrhage vestibular disease	MS, drugs (anti-convulsants), spinal cord compression	CT
	subacute	Drugs, cerebellar tumor, meningitis	MS, intoxication (mercury)	CT

Spinal cord compression



A 66 year-old man with a history of lung cancer presented with a three-week history of mid-back pain followed by rapidly progressive paraplegia and incontinence over 24 hours.

Transverse myelitis

A 23 year-old woman presented with paresthesia of the arms and legs for two days. Neurological examination showed sensory loss from the shoulders down bilaterally and bilateral Babinski responses.

Common emergency syndromes

Syndrome	Onset	Probable diagnosis	Diagnosis to exclude	Best tests
Drowsy patient with ataxia	acute	Cerebellar infarct or hemorrhage	Brainstem stroke Drugs	CT
	subacute	Drugs Cerebellar tumor	Intoxication, hydrocephalus	CT
Alert with dizziness	acute subacute	Vestibular disease	Brainstem stroke, MS,	CT, otology consult

History suggesting a structural lesion

Very acute onset	Cerebrovascular lesion
Trauma	Subdural hematoma – SDH
Bleeding	Intracranial hemorrhage or SDH
Headache	Increased intracranial pressure
Tumor	Metastasis
Recent sepsis or bacterial infection of the face	Brain abscess
Alcoholism	Subdural hematoma
Focal neurologic symptoms	Any structural lesion

General examination suggesting a structural lesion

Hypertension	Increased intracranial pressure (ICP) or cerebellar mass
Bradycardia	Increased ICP or cerebellar mass
Other arrhythmias without cardiac arrest	Increased ICP or cerebellar mass
Fever	Brain abscess
Purulent infection of the face or sinuses	Brain abscess
Trauma	Subdural hematoma
Bleeding	Intracranial bleeding, subdural hematoma
Tumor	Metastasis

Neurologic examination suggesting a structural lesion

Diffuse signs

- Eyes

  papilledema,
  hemorrhage in fundus
- Limbs

  severely increased tone
- Reflexes

  grossly increased deep tendon reflexes

Focal signs

- Eyes

  deviation of both eyes to one side
  unequal light reflex
  unequal pupils
  failure to move in one direction of gaze
- Limbs

  consistently asymmetric positions
  asymmetric tone
  hemi-, monoparesis
- Reflexes

  consistently asymmetric deep tendon reflexes
  pyramidal signs

Syndromes of focal neurologic signs

Syndrome	Usual Localization
Hemiparesis, hemisensory loss, aphasia, hemianopia	Contralateral cerebral hemisphere
Hemiparesis without other findings	Small deep infarct in contralateral hemisphere or pons
Hemiparesis with contralateral cranial nerve findings	Branstem
Hemiparesis with contralateral trunk and limb sensory loss	Cervical spinal cord

Syndromes of focal neurologic signs

Syndrome	Usual Localization
Paraparesis	Thoracic or lower spinal cord or nerve roots
Monoparesis	Brachial or lumbar plexus
Weakness of isolated muscle of one limb	Peripheral nerve or spinal nerve root lesion
Bilateral distal limb numbness or weakness	Peripheral neuropathy
Bilateral proximal limb weakness without sensory symptoms	Muscle or neuromuscular junction

Principle 5

If structural lesion is suspected immediately begin to minimize the effects of the lesion on the brain and to treat complications

- Slow down the rate of infusion of any iv
- Dexamethazon i.v.
- Osmotic diuretics
- Transfer to specialized institution

Principle 6

Any patient with progressive weakness in both legs has spinal cord compression until proved otherwise

Principle 7

The patient with neurologic signs and fever should always be considered to have bacterial meningitis, until it is ruled out by lumbar puncture

Principle 8

The patient with progressing symptoms is going to get much worse, and soon

Lesions of the nervous system can progress rapidly to cause severe, irreversible damage and death

Physicians and nurses must make frequent, at lest every 15 minutes, observations of vital signs, level of consciousness and focal signs for several hours, or until the patient is clearly improving

Any deterioration of the signs should prompt rapid decisions about intubation, immediate treatment, rapid diagnostic work-up, neurosurgical consultation, etc.

Principle 9

Do nothing that compromises the already injured nervous system

- If increased ICP or focal mass-causing lesion is suspected, the rate of administration of intravenous fluids should be limited
- In the same clinical setting, lumbar puncture should not be done
- In any patient with serious head injury or a patient with qudriparesis, suspect a neck injury and immobilize the neck until adequate cervical X-rays rule out a fracture

Principle 9

Do nothing that compromises the already injured nervous system

- In patient with stroke syndrome never anticoagulate until an intracranial hemorrhage has been ruled out by CT scan
- Don't give sedating drugs to a patient with increased ICP or a suspected intracranial mass.

Principle 10

Don't assume the patient is lost

- In the early hours of a neurologic emergency do not assume irreversible brain damage or brain death, no matter how ominous the clinical signs
- The patient should be vigorously supported and managed until
  - the etiologic diagnosis is certain
  - other complicating factors are ruled out
  - early self-reversing effects of acute brain injury have resolved, e.g. concussive, hypoxic, postictal effects (a reasonable period to wait is 6 hours)