Cerebrovascular Anatomy and Disease

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Cerebral Hemispheres: Gray Matter

Cerebral Hemispheres: White Matter

- Transverse (commissural) fibres interconnect the two cerebral hemispheres (mainly the corpus callosum)
- Projection fibres connect the cerebral cortex with lower portions of the brain or the spinal cord.
Cerebral Hemispheres: Basal Ganglia

- Includes the
  - Caudate nucleus
  - Putamen
  - Globus Pallidus
- Together they are referred to as the Corpus Striatum
- Extrapyramidal System
  - Basal ganglia
  - Interconnections
  - Neurotransmitters

Primary Motor Cortex

- The primary motor projection cortex is located on the anterior wall of the central sulcus.
- These cells control voluntary movements of skeletal muscle on the opposite side of the body.

Primary Sensory Cortex

- The primary sensory projection cortex is located in the postcentral gyrus and is called the somatesthetic area
- This area receives fibers that convey touch and proprioceptive (muscle, joint, and tendon) sensations from the opposite side of the body.
Blood Supply to the Brain

- The brain is one of the most metabolically active organs in the body.
- The brain receives its blood from two pairs of arteries, the carotid and vertebral.
- The vertebral-basilar arterial blood is mainly distributed to tissue in the posterior fossa. The carotid supplies the remainder of the brain.

Cerebral Angiography

Extracranial Circulation

- Aortic Arch
  - Carotid Arteries
  - Vertebral Arteries
Extracranial Circulation

- Common Carotid
  - Internal Carotid
  - External Carotid

Internal Carotid Circulation

- Ophthalmic
  - Optic Nerve & retina
  - Anastomotic Ex ICA
- Anterior Choroidal
  - Optic Tract
  - Cerebral peduncles
  - LGN
  - Posterior limbic
- PCom
  - Anastomotic ICA to PCA
  - Superior hypophysial

Internal Carotid
Vascular Territories Internal Carotid

- Middle Cerebral Artery
- Anterior Cerebral Artery
- Posterior Cerebral Artery

Clinical Syndromes

- Middle cerebral artery
  - Contralateral hemiplegia
  - Hemisensory arm > leg
  - Hemi or quadrantopia
  - Paralysis of gaze (opposite)
  - Aphasia (dominant hemisphere) / dysarthria
  - Neglect (non-dominant hemisphere)
  - Perforators (lacunar infarct)

Clinical Syndromes

- Anterior Cerebral Artery
  - Contralateral hemiplegia
  - Hemisensory loss leg > arm
  - Impairment of gait/stance
  - Akinetic mutism
  - Dysexecutive syndrome
Clinical Syndromes

- Posterior Cerebral
  - Hemianopia
  - Memory deficits
  - Perseveration
  - Severe visual deficits
- Thalamus
- Cerebral peduncle
- Brain stem - CN palsies
- Nystagmus

Vertebral Basilar

Vertebral Basilar
Clinical syndromes

- Anterior Spinal Artery
- Medial medullary syndrome
- PICA
  - Lateral medullary syndrome
  - Horner’s syndrome
- Basilar
  - Paramedian Branches (Pons)
    - Corticospinal tract
    - Lateral rectus muscle paralysis
  - Circumferential (Pons)
    - Ataxia (cerebral peduncles)
    - Vertigo, nausea, nystagmus (vestibular and cochlear nuclei)
- Basilar
  - Midbrain paramedian branches
    - Corticospinal tracts
    - Eye motor activity

Cerebrovascular Disease

Cerebral Aneurysm

- Cerebral aneurysms usually occur at the bifurcations and branches of the large arteries located at the Circle of Willis.
- The most common sites include the:
  - Anterior Communicating artery (30 - 35%)
  - bifurcations of the Internal Carotid and Posterior Communicating artery (30 - 35%)
  - bifurcation of Middle cerebral (20%)
  - Basilar artery bifurcation (5%)
  - Remaining posterior circulation arteries (5%)
Arterio-Venous Malformation (AVM)

- Arterio-venous malformation (AVM) of the brain is a "short circuit" between the arteries and veins.
- Normally the connection between arteries and veins is through a network of smaller vessels (capillaries) which slow the blood down and permit the exchange of food, oxygen and nutrients into the tissues.
- In arterio-venous malformations, the arteries and veins have a direct connection, bypassing the capillary network.
Arterio-Venous Malformation (AVM)

Vascular Occlusion
Vascular Occlusion

Fistula

Fistula
Questions????

Thank you