

Neurovascular Disorders

**First Edition
January 2023**

**History
Diagnosis
Therapy**

By

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**TO THOSE,
WHO ARE SUFFERING**

Preface

Rapid advances in the field of CNS disorders have opened a new route of diagnostic and therapy in this field.

Knowledge of current concepts associated with vascular disorders of CNS around the world is a crucial issue for providing appropriate evaluation, referral and treatment of patients with vascular diseases of CNS.

The main goal of this book is to provide broad based current knowledge of diverse fields of vascular disorders of CNS on a high level.

The book contains a compact text from several neurosurgical sources consisting of many journals and books, which have been published currently in the neurosurgical field.

The topics have been arranged in Top Down starting from cerebral vascular disorders to the spine to provide the readers with sound knowledge base in the fundamentals of vascular anatomy, history, vascular imaging, clinical assessment and also operative and non-operative therapy of vascular disorders of CNS.

The text has been made spare and concise therefore it could be read quickly in the clinic during the patient rounds, daily work and also in the operating room.

We have created about 44 tables by ourselves in the hope to keep the readers attention to the essential points and to avoid unnecessary details.

In addition we have integrated about 71 suitable original photographs into the book. The most important clinical and radiological features were usually labeled and highlighted in color.

The intended audience will be wide ranging including from medical student, residents, fellows, of course neurosurgeons and neuroradiology.

The book may also be of interest to physicians and nurses working at the ICU as well as patients with vascular diseases of CNS.

We are especially grateful to Dr. A. Khadem for bringing this book to editorial and technical completion.

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Vascular Disease of CNS

Neurovascular Anatomy of CNS

Feeding Arteries

Anterior Circulation (Internal Carotid Artery)

Internal Carotid Artery

Internal carotid artery (ICA) is the main artery for feeding the supra-tentorial brain structure. There are several systems for identifying the anatomical segments of ICA such as traditional numbering and Fischer system.

Tab. 1 shows the different parts and segments of ICA

1. Cervical Part: It begins from the carotid bifurcation and extends into the carotid canal of petrous bone
2. Petrous Part: Still accompanied by PGSN extends into the foramen lacerum to Gasserian ganglion
3. Cavernous Part: Surrounded by vascular sinuses, still lies in PGSN and gives out the following branches:
 4. Proximal branch meningo-hypophyseal trunk
 5. Anterior meningeal artery
6. Clinoid Part: There is new evidence that this segment also still lies intra-cavernous
7. Supra-Clinoid Part: Divides itself into 3 branches:
 8. Ophthalmic Segment: Extends between origin of ophthalmic artery and communicating artery communicating Segment: Extends from CA to the origin of the anterior choroidal artery.
 9. Choroidal Segment: Extends from its origin to the bifurcation of MCA and gives several branches
10. Anterior choroidal artery: arises from the ICA before its bifurcation into the MC- and AC arteries.
11. Lateral Posterior Choroidal Artery: arise from PCA and supplies atrium, temporal horn and body of lateral ventricle.
12. Medial posterior Choroida Artery: arises also from PCA and supplies the choroid plexus in the roof of third ventricle and also all important neuro-structure of diencephalon.

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- Cervical part of ICA encircled by Postganglionic Sympatric Nerves (PGSN) and runs postero-medially to the ECA, and gives no further branches before entering the SB.
- Communicating segment of supra-clinoid part of ICA gives its main branch pre-mammillary (anterior talamo-perforating artery), which extends into the III ventricle.
- Ophthalmic segment of supra clinoid part gives out I-V branches as superior hypophyseal arteries.
- Choroidal segment of supra clinoid part gives perforating branches to optic tract and uncus, and also the main choroidal arteries.
- Anterior choroidal artery: supplies the choroid plexus of the atrium and temporal horn and also several neural structures surrounding to the ventricle.

Anatomy of Circle of Willis

Circle of Willis is a symmetrical communicating arterial pathway formed by an arterial polygon as the internal carotid and vertebral systems anastomose around the optic chiasm and infundibulum of the pituitary stalk. This communicating pathway allows equalization of blood-flow between two sides of the brain through the connection between the middle cerebral artery with the posterior cerebral artery and basilar system. This makes an anastomotic circulation possible, should a part of the circulation be occluded.

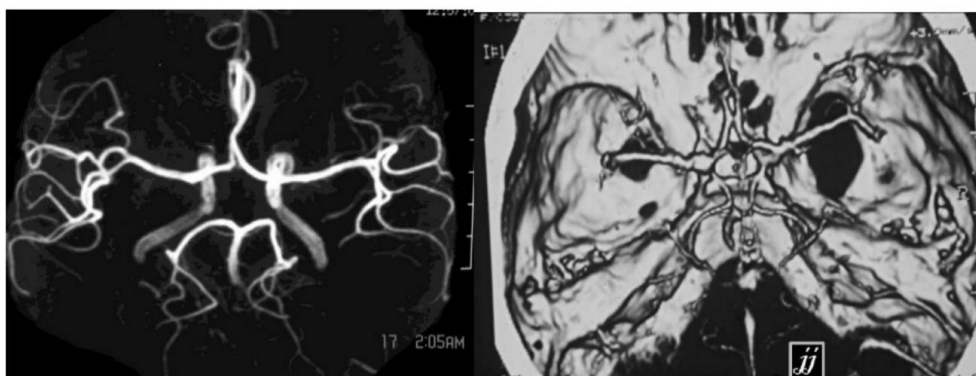


Fig. 1 & 2: non--contrasted MRA and Axial CTA show Willis Circle

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Cerebrovascular Disease

Intracranial Occlusion Disease

Cerebral Artery Occlusion

Ischemic Stroke

Introduction

Acute occlusion of cerebral arteries results in a stroke with sequel neurological deficits, depending on the location of the lesion. This basically occurs in two forms such as ischemic (Brain infarction) in about 80% of patients and hemorrhagic infarct in 20% of cases. An ischemic stroke occurs when a region of cerebral blood flow is suddenly stopped or limited. This may occur by vessel occlusion or by low blood flow. Cerebral blood flow (CBF) rates of less than 20 mL/100 g/min may produce infarction.

Incidence of ischemic infarct

The incidence of ischemic stroke is 150 to 350/100,000 citizens per year in the world. Ischemic stroke causes 80% of all strokes. According to the New England Medical Center stroke registration that 58% of patients are male and 42% are female, with the mean age of stroke being 61.5 years (5). Stroke incidence dramatically increases in the elderly population secondary to cardiovascular disease. Stroke is more common in African Americans than in white or Hispanic populations in the United States.

Etiopathology

Acute cerebral artery occlusion by an embolus or thrombosis is the most common causes. Due to the interruption of blood flow to a brain area, neuron metabolism is disturbed caused by lack of oxygen and glucose delivering through the involved artery. Cell death may occur after approximately 6 minutes of halted blood circulation.

The infarct area is comprised of a central area (umbra) with highly concentrated cell death, surrounded by a (penumbra) of tissue containing stunned cells that may recover. This may occur after reestablishing of blood circulation or producing nearby collateral vessels. Rapid restoration of blood flow is the most effective factor of preserving brain cells. Large cortical neurons are especially sensitive to ischemia.

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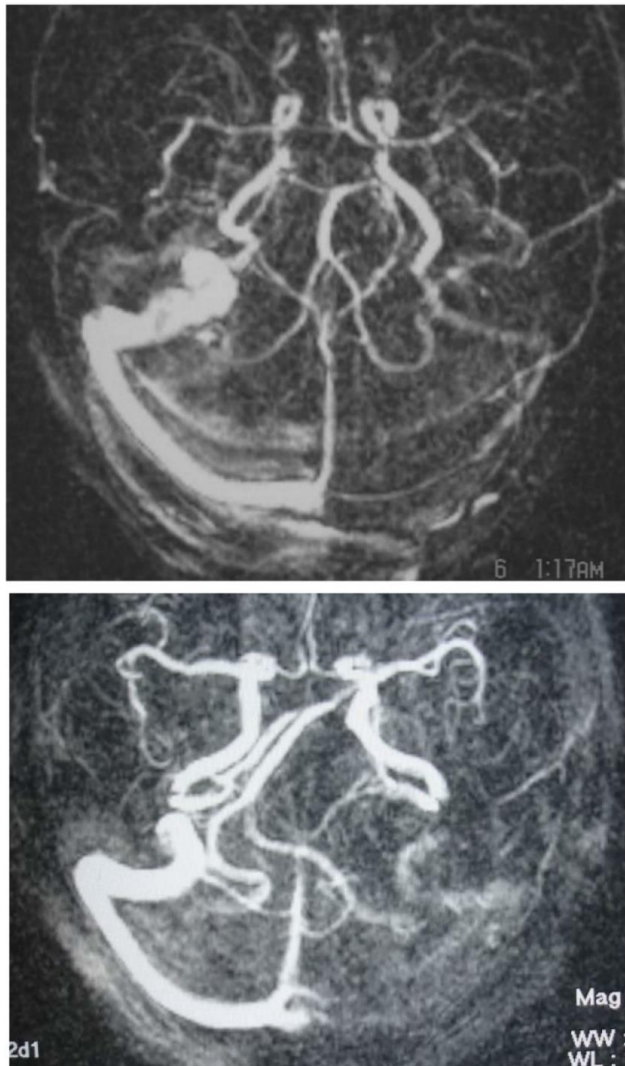


Fig. 6 & 7: Axial MRV of brain show thrombosis of left lateral and sigmoid sinus

Symptoms

These may vary from lethargic to comatose, but some patients may present agitation associated with sensory Motor dysfunction. Occasionally, the cranial nerves also are involved with resultant in CN paresis.

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