# Medical, Surgical and Interventional Treatment of Cerebral Ischaemia

*Essay*

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*Presented by*

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| | |
|---|---|
| **ACA:** | Anterior Cerebral Artery |
| **AICA:** | Anterior Inferior Cerebellar Artery |
| **CEA:** | Carotid Endarterectomy |
| **CT:** | Computed Tomography |
| **DINDs:** | Delayed Ischaemic Neurological Deficits |
| **DSA:** | Digital Substraction Angiography |
| **DST:** | Dural Sinus Thrombosis |
| **ECA:** | External Carotid Artery |
| **F:** | French |
| **ICA:** | Internal Carotid Artery |
| **IU:** | International Unit |
| **MCA:** | Middle Cerebral Artery |
| **MRA:** | Magnetic Resonance Angiography |
| **MRI:** | Magnetic Resonance Imaging |
| **PCA:** | Posterior Cerebral Artery |
| **PICA:** | Posterior Inferior Cerebellar Artery |
| **PTA:** | Percutaneous Transluminal Angioplasty |
| **TIA:** | Transient Ischaemic Attack |
| **t-PA:** | Tissue Plasminogen Activator |
| **UK:** | Urokinase |
| **VA:** | Vertebral Artery |

# INTRODUCTION

Stroke is the most common cause of death in the world after coronary heart disease and all cancers, causing about ٤ million deaths in ١٩٩٠, three quarters of them in developing countries ***(Murry and Lopez, ١٩٩٧).***

It is the most common life threatening neurological disease ***(Warlow, ١٩٩٧).***

A stroke (previously known as cerebrovascular accident) is rapidly developing clinical symptoms and/or signs of focal, and at times, global loss of brain function with no apparent cause other than that of vascular origin. There is wide range of severity from recovery in a few days, trough persistent disability, to death ***(Hatano, ١٩٧٦).***

A transient ischaemic attack (TIA) is an acute loss of focal brain function with symptoms lasting less than ٢٤ hours and which is thought to be due to inadequate cerebral blood supply as a result of arterial thrombosis, embolism or low flow associated with arterial, cardiac or haematological diseases ***(Hankey and Warlow, ١٩٩٤).***

About ٨٠ percent of all first-ever-in-life time strokes are ischaemic, ١٠ percent are due to primary intracerebral hemorrhage and in the remainder there is uncertainty ***(Charles Warlow, ٢٠٠١).***

Management of cerebral ischaemia includes medical, surgical and interventional measures.

Medical measures include risk factors control, antiplatlets, anticoagulants, and recently thrombolytic agent are used in acute stroke management. Antiplatelet, especially aspirin, has small but definite benefit probably because its anti-platlet action reduces the risk of early recurrent ischaemic stroke ***(Charles Warlow, ٢٠٠١).***

Anticoagulants as heparin are used on assumption that by inhibiting thrombus propagation and recurrent embolization it improves the outcome of stroke ***(Charles Warlow ٢٠٠١).***

Recently intravenous thrombolysis is used for treatment of acute ischaemic stroke. The physiologic and biochemical bases of thrombolytic therapy lies in the ability to affect the pathway of fibrinolysis and conversion of plasminogen into plasmin ***(Michael Chicone, ١٩٩٦).***

The surgical treatment of cerebral ischaemia include carotid endarterectomy, vertebral endarterectomy, cerebral revascularization and surgery for acute brain infarction with mass effect.

The use of carotid endarterectomy (CEA) in prevention of ischaemic stroke was first described in ١٩٥٤. It was never well studied in randomized study until the past decade. Recent cooperative trials have been undertaken to determine the best indications for such procedure.

***(Barnett et al., ١٩٩٨)***

The interventional measure for treatment include percutaneous transluminal angioplasty (PTA) and stenting, and intra-arterial thrombolysis.

Following the favourable results obtained in treatment of coronary artery diseases, combined angioplasty and stenting has been advocated for treatment of carotid stenosis as well. The results of early series have suggested that endoluminal revascularization in high risk patients can be performed with an acceptable degree of safety ***(Albuquerque et al., ١٩٩٨).***

If intra-arterial thrombolysis is proved effective within ٦ hours of stroke onset, the landscape of acute stroke treatment should change drastically. Stroke centers with interventional capabilities must be prepared to receive referrals from surrounding hospitals that must select patients likely to benefit from such therapy ***(Lawrence, ١٩٩٩).***

# Aim of the Work

The aim of the work is to review the literature on the pathology, clinical features, investigations and to evaluate the different modalities for treatment of cerebral ischaemia which include medical, surgical and interventional measures.

# ARTERIAL BLOOD SUPPLY OF THE BRAIN

The brain is supplied by ٢ system of arteries:

١. The carotid system of arteries.
٢. The vertebrobasilar system.

## Carotid System of Arteries

### Common Carotid Arteries (CCA)

The right and left carotid arteries differ in length and origin. The right carotid artery is exclusively cervical and it originates from the brachiocephalic trunk behind the right sternoclavicular joint.

The left carotid originates directly from the aortic arch immediately posterolateral to the brachiocephalic trunk and therefore has both thoracic and cervical parts.

**Thoracic Part of the Left Common Carotid Artery**

This part ascends until the level of the left sternoclavicular joint where it enters the neck. It is ٢٠-٢٥ mm long and it lies at first in front of the trachea, then it inclines to left ***(Giorgio Gabella, ١٩٩٥).***

**Cervical Part of Both Common Carotid Arteries**

It ascends, diverging laterally from behind the sternoclavicular joint, to the upper border of the thyroid cartilage, where it divides into external and internal carotid arteries. At its division the vessel has a dilatation which is the carotid sinus. Each of these parts is contained in a carotid sheath, continuos with the deep cervical fascia and of loose texture, this sheath encloses also the internal jugular vein and vagus nerve, the vein lies lateral to the artery, the nerve between them and posterior to both ***(Giorgio Gabella, ١٩٩٥).***

## External Carotid Artery (ECA)

It begins lateral to the upper border of the thyroid cartilage, at the level of the disc between the third and fourth cervical vertebrae.

It first ascends slightly forward and then inclines backward and a little laterally to pass midway between the mastoid tip and mandibular angle where, in the substance of the parotid gland behind the neck of the mandible, it divides into superficial temporal and maxillary arteries.

**Branches:**

| | |
|---|---|
| ١. Superior thyroid | - Occipital |
| ٢. Ascending pharyngeal | - Posterior auricular |
| ٣. Lingual | -Superficial temporal |
| ٤. Facial | - Maxillary |

***(Giorgio Gabella, ١٩٩٥)***

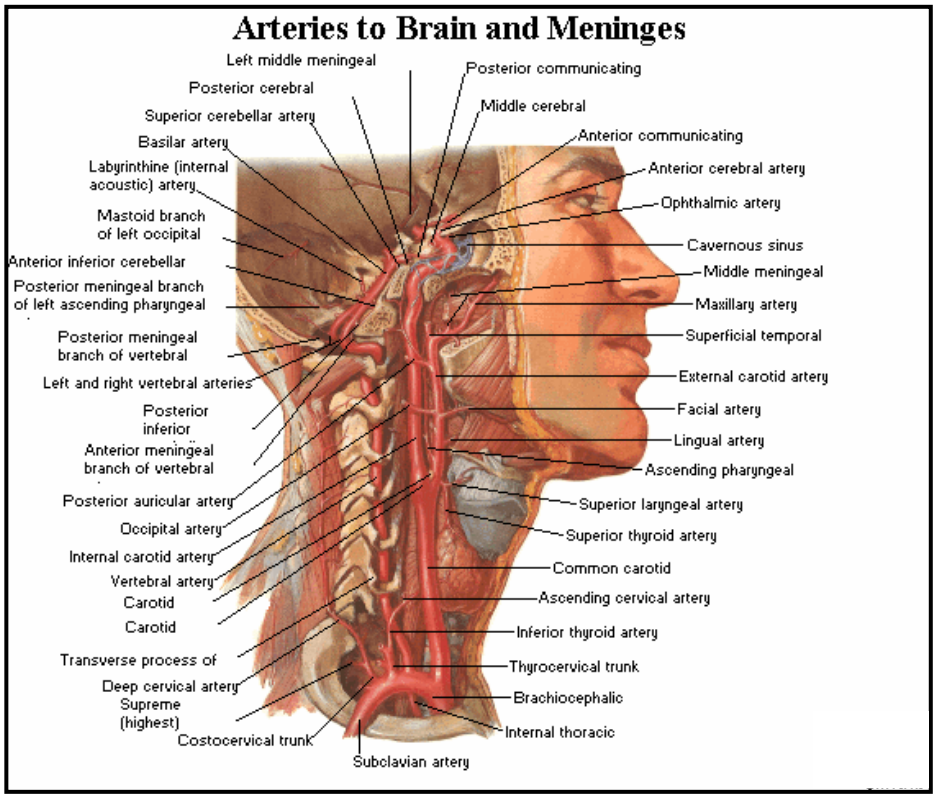


**Figure (١):** Arteries to brain and meninges

***(Frank H. Netter ١٩٩٧)***

# Internal Carotid Artery (ICA)

## *Portions of the internal carotid artery*

The internal carotid artery is divided into ٤ segments:

I. Cervical ($C_1$ portion).
II. Petrous ($C_2$ portion)
III. Intracavernous ($C_3$ portion)
IV. Suprachlinoid ($C_4$ portion)