Chapter -1

INTRODUCTION
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Cerebrovascular diseases present one of the leading problems of the modern mankind. They are followed by the risk of high mortality rate, and cause high level of disability with people who survive cerebral-vascular incident (stroke, apoplexy) (Voljevica et al., 2005).

Stroke has been defined as “rapidly developing clinical signs of focal (or global) disturbances of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin” by WHO (Aho, 1980).

In India, prevalence rate of stroke range from 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on recent population based study (Pandian & Sudhan, 2013).

Knowledge of Neuroanatomy & vascular anatomy is important for clinical diagnosis of stroke and transient Central Nervous System ischemia (Ingall, 2004).

The brain is absolutely dependant on a continuous supply of oxygenated blood (Fitzerald, 2007).

The average brain receives about 750ml of blood per minute, almost 20% of total blood volume indicating a large supply of oxygen & nutrients especially glucose. Two pair of major arteries – right & left vertebrals; right & left internal carotid arteries deliver all their blood almost exclusively to the brain (Patetas, 2007).

In 1962, Thomas Willis, was the first scientist to describe the Circulus arteriosus, the major blood supply to the brain (Paul and Mishra, 2004) The Circle of Willis is a hexagon of vessels that gives rise to all of the major. Cerebral arteries. It is fed by the paired Internal carotid arteries and the Basilar Artery (Waxman, 2013).
The circulus arteriosus, Circle of Willis lies in the subarachnoid space within the deep interpeduncular cistern, and surrounds the optic chiasma, the infundibulum and other structures of the interpeduncular fossa. Interiorly, the anterior cerebral arteries, which are derived from the Anternal carotid arteries are joined by the small Anterior communicating artery. Posteriorly, the two Posterior cerebral arteries, which are formed by the division of Basilar artery are joined to the ipsilateral Internal carotid artery by the Posterior communicating artery.

There is considerable individual variation in the pattern and calibre of vessels which make up the circle of Willis (Standring S, 2005).
Based on anatomical and radiological studies it has been shown that 50% of healthy control subjects have anatomical variations in Circle of Willis. Variations of cerebral haemodynamics as a collateral anastomotic network and patients with effective collateral circulation have a lower risk of Transient Ischemic Attack and stroke than those with ineffective collaterals.

Fetal configurations were found in autopsy of brains with infarcts than in brains without.

A correlation exists between cerebral aneurysms and certain variations of circle of Willis (De Silva, et al., 2011)

Higher percentage of abnormality of length and diameter of the vessels of circle of Willis have been reported in the mentally ill, and those with cerebrovascular catastrophe indicating a possible linkage. (Kamath, 1981)

Different distributions of variations of circle of Willis may partially explain the different incidence of some cerebrovascular diseases in different ethnic or racial groups. Incidence of ischaemic stroke is different among different populations especially Blacks & Hispanics compared to Whites.

Incidences of intracranial aneurysms show ethnical differences. (Efthekar,2006)

Prevalence of intracranial aneurysms is 4%. 85% of saccular aneurysms occur in the circle of Willis. Rupture of intracranial aneurysms may lead to brain parenchyma hemorrhage or often subarachnoid hemorrhage (Keedy,2006).

Knowledge of presence of aneurysms and the presence of normal variations i.e. fenestrations, duplications, persistent fetal arteries play a crucial role in the diagnosis and
management of acute stroke and subarachnoid haemorrhage and also surgical planning (Dimmick & Faulder, 2009).

Assamese population can be divided broadly into Tribals & Non-Tribals (the majority). In Assam there are as many as 23 Tribal communities which constitute 12.82% of the total population of the state. (Saikia, Medhi and Medhi, 2012).

A study of the variations in the calibre and pattern of the vessels in the Circle of Willis in the (Assamese population Tribal & Non-tribal), in different ages has been attempted ;the knowledge of which will be of considerable help to neurosurgeons, neurologists and other branches of medicine in Assam.

**OBJECTIVES OF STUDY**

The present study on the Circle of Willis of human brain specimens has the following objectives:

1. Study of the anatomical pattern of the Circle of Willis including its variations and anomalies (eg. aneurysms) present in the Tribal and Non-Tribal populations of Assam.

2. Study of the Calibre (i.e. External diameter and lengths) of the arteries of the Circle of Willis in different age groups in the Tribal and Non-Tribal populations of Assam.