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List of Abbreviations

3DVR	**Three Dimensional Volume Rendering**
ACA	Anterior Cerebral Artery
ACOM	Anterior Communicating Artery
ADC	Apparent Diffusion Coefficient
ASPECTS	Alberta Stroke Program Early Ct Score
BA	Basilar Artery
CCA	Common Carotid Artery
CT	Computed Tomography
CTA	Computed Tomography Angiography
CTP	Computed Tomography Perfusion
DSA	Digital Subtraction Angiography
DWI	Diffusion Weighted Imaging
EMT	Endovascular Mechanical Thrombectomy
FD-CT	Flat-Detector CT, also known as dyna-CT
FLAIR	Fluid Attenuation Inversion Recovery
ICA	Internal Carotid Artery
INR	Interventional Neuroradiology
IQR	Interquartile Range
MCA	Middle Cerebral Artery
mpCTA	Multiphasic CT Angiography

List of Abbreviations

MR	**Magnetic Resonance**
MRA	Magnetic Resonance Angiography
mRs	Modified Rankin's Score
MS-CT	Multi-Slice CT
mTICI	Modified Thrombolysis In Cerebral Infarction Score
NIHSS	National Institute Of Health Stroke Scale
PACS	Picture Archiving & Communication System
PCA	Posterior Cerebral Artery
PCOM	Posterior Communicating Artery
rLMC	Regional Lepto-Meningeal Contrast Score
SD	Standard Deviation
spCTA	Single Phase CT Angiography
tMIP	Temporal Maximum Intensity Projection
VA	Vertebral Artery

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INTRODUCTION

Stroke is acute central nervous system injury with an abrupt onset, which is due to acute ischemia in approximately 80% of cases. Stroke poses a great cost to the society in terms of both morbidity and mortality, in addition to huge economic burden. It is a leading cause of serious long-term disability ***(Mozzafarian et al., 2015).***

Regarding regional data from Egypt, it has been reported that total lifetime prevalence rate of cerebrovascular stroke (CVS) is 5.08 & 5.6 per 1000 population, in Upper Egypt & New Valley respectively. Among all etiologies of acute stroke, thrombosis had the highest prevalence (4.2 per 1000) ***(Farghaly et al, 2013).*** Regarding the relative frequency of CVS among other neurological disorders, it ranks the first disorder, constituting 58.5% of those admitted to neurology department of Assiut university hospital during one year, 2003. Mortality rate of stroke patients admitted to the same department during the same year was 26.8% at hospital discharge ***(Kandil et al, 2006).***

In each minute, an untreated patient experiencing a typical large vessel acute ischemic stroke loses 1.9 million neurons, 14 billion synapses, and 12 km of myelinated nerve fibers ***(Saver, 2006).*** Thus, the goal for the management of such patients is to complete initial evaluation, including history, examination, laboratory and imaging studies, as soon as possible. Fortunately, nowadays we are witnessing the dawn of a new era, owing to positive results from several recently published trials conclusively proving the benefit of mechanical endovascular thrombectomy over best medical therapy for selected patients with acute ischemic stroke ***(Pierot and Derdeyn, 2015).*** There was almost consensus that for optimum outcomes, onset-to-groin puncture time interval should be less than 6 hours ***(Powers et al, 2015).***

Until now, no cases of acute stroke have received endovascular therapy at our hospital. However, few sporadic cases have been done at the private hospital attached to our university, Ain Shams University Specialized Hospital, with variable technical & clinical outcomes. At our institute, we neither have a clear management protocol for acute stroke patients, nor have local statistics about our time performance regarding such patients. Thus, time-wise, we are unsure if it is feasible or not to offer endovascular therapy as a routine treatment for candidates with potentially salvageable brain tissue, which would consequently require implementation of relevant personnel training & equipment.

AIM OF THE WORK

The first aim of our work is to assess our timeliness, and consequently assessing our readiness to implement acute stroke endovascular therapy, by evaluating aspects of time performance in dealing with such time-critical group of patients, and to detect points of delay in the “chain of brain”, then presenting the results to local healthcare policy makers for application of possible corrective measures to shorten such times, because “time is brain”. Then, sometime after relevant corrective measures will have been implemented, a re-audit shall be done to measure the improvement in delays.

The other aim of this study is to recommend tailored imaging protocols for salvageable brain tissue & large vessel occlusion detection (e.g. CT angiography, CT perfusion, MR angiography, MRI perfusion, MRI DWI, etc.) suiting facilities, expertise & needs of our hospital, with the ultimate goal of providing rapid, yet accurate radiology reports for such patients. There’s also potential applicability of the whole process to other university hospitals in Egypt & other similar settings.

RADIOLOGIC ANATOMY

The brain is rich in blood supply, with a densely branching arterial network. Being supplied by two internal carotid arteries (representing 'anterior curculation') and two vertebral arteries (representing 'posterior circulattion') which form a complex anastomosis (circle of Willis '*circulus arteriosus*') at the base of the brain ***(Kapoor et al., 2007)***

Internal Carotid Artery (ICA)

It originates as the largest terminal branch of the common carotid artery in the neck at the level of the fourth cervical vertebra approximately. Alongside its branches, it supplies the forebrain, except the occipital lobe ***(Gallucci et al., 2007).***

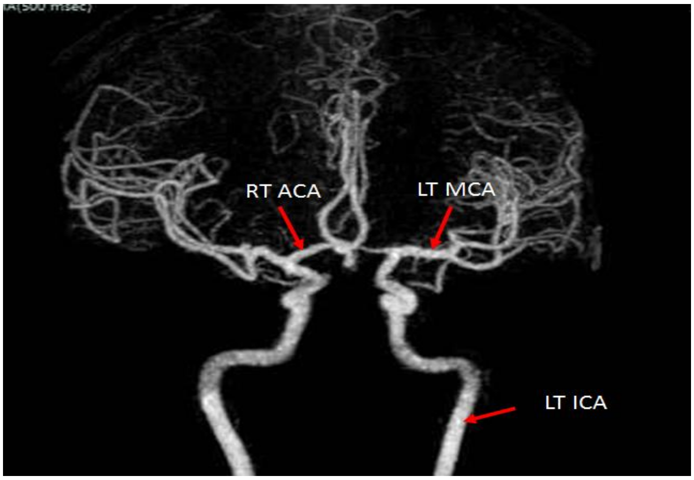

Fig. (1): Computed tomographic angiography (CTA) 3-dimensional volume rendering (3DVR) of the anterior circulation, anteroposterior (AP) view. (Image from Radiology department, Ain Shams University)

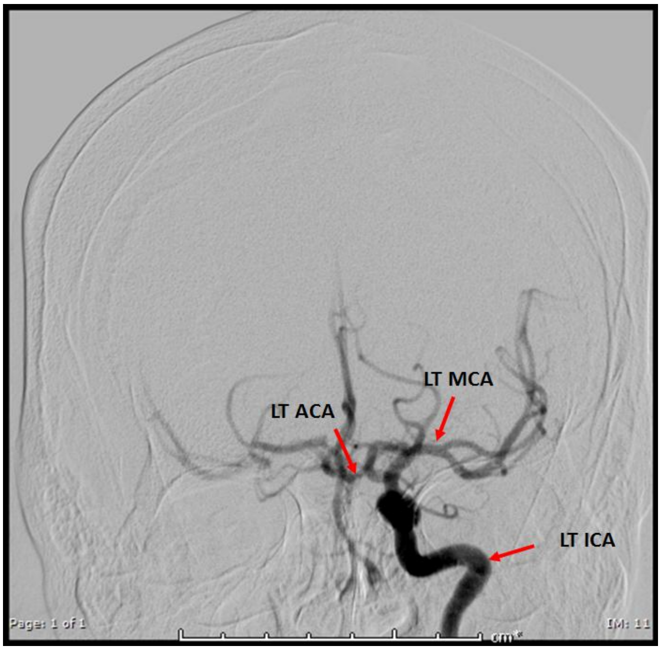

Fig. (2): Digital Subtraction Angiography (DSA) of the ICA, Towne's view, branching into MCA (the more horizontal branching) & ACA (the more vertical branching). (Image from Radiology department, Ain Shams University).

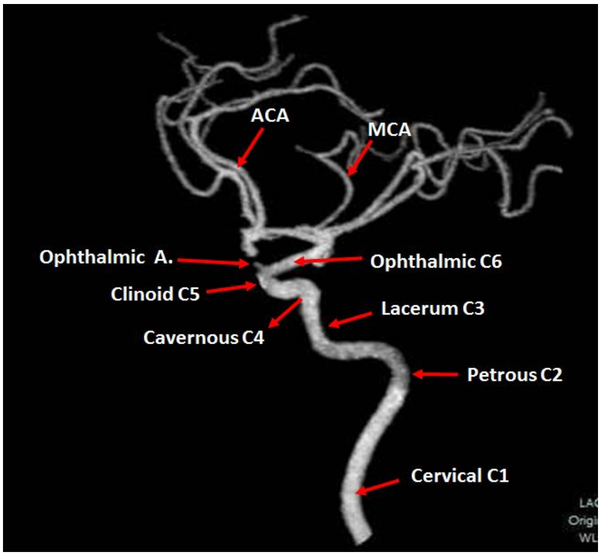

Fig. (3): CTA, 3DVR of right ICA, lateral view, branching into MCA (the more horizontal branching) & ACA (the more vertical branching). (Image from Radiology department, Ain Shams University)

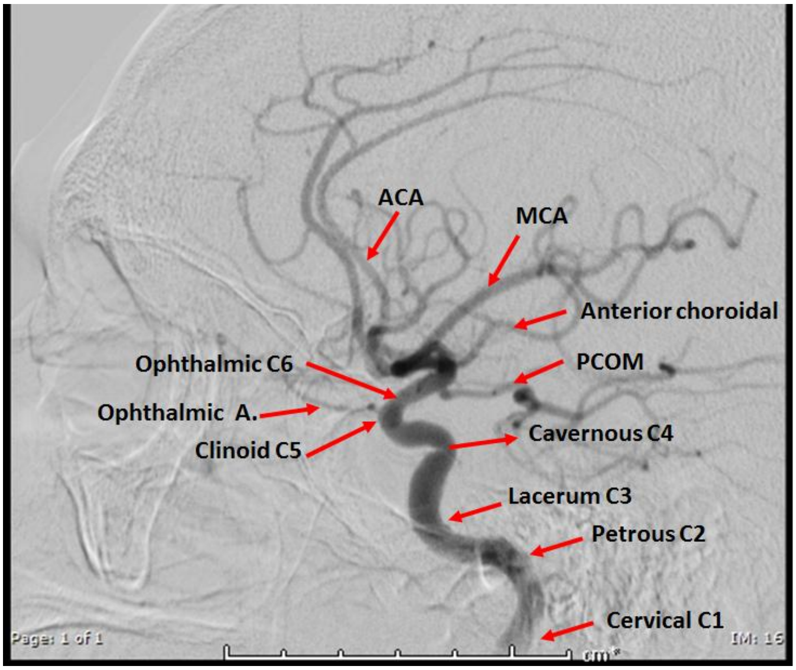

Fig. (4): Digital Subtraction Angiography (DSA) of the ICA, lateral view, branching into MCA (the more horizontal branching) & ACA (the more vertical branching). (Image from Radiology department, Ain Shams University).

ICA can be divided into seven segments, with their corresponding branches listed under each segment:

- ***Cervical portion (C1):*** begins at the bifurcation of the common carotid artery, and ascends to the carotid canal.
- ***Petrous portion (C2):*** at the petrous portion of the temporal bone.
    - Vidian artery
    - Caroticotympanic artery

- ***Lacerum portion (C3):*** it extends from the intracranial carotid canal.
- ***Cavernous portion (C4):*** it is situated inside the cavernous sinus, forming its roof.
    - Meningohypophyseal trunk.
    - Inferolateral trunk.
- ***Clinoid Portion (C5):*** it is the shortest part of the ICA.
- ***Ophthalmic portion (C6):*** it ends proximal to the posterior communicating artery origin.
    - Ophthalmic artery from, passes through optic canal
    - Superior hypophyseal artery
- ***Communicating portion (C7):*** it ends by giving its terminal branches, anterior cerebral artery (ACA) and middle cerebral artery (MCA).

(Bouthillier et al., 1996)

- The posterior communicating artery (PCOM) anastomoses with the posterior cerebral artery (PCA). From its posterior half some perforating arteries arise, which supply the medial surface of the thalamus and the walls of the third ventricle ***(Gallucci et al., 2005).***
- Anterior choroidal artery enters temporal horn ***(Osborn, 2006).***

Middle Cerebral Artery (MCA)

It is the larger terminal branch of the internal carotid**.** It can be divided into four parts:

- **M1** (sphenoidal): from the termination of the internal carotid artery to the bi/trifurcation.
- **M2** (insular): running in the lateral (Sylvian) fissure.
- **M3** (opercular): coming out of the lateral fissure.
- **M4** (cortical portions)

(Osborn, 2006)

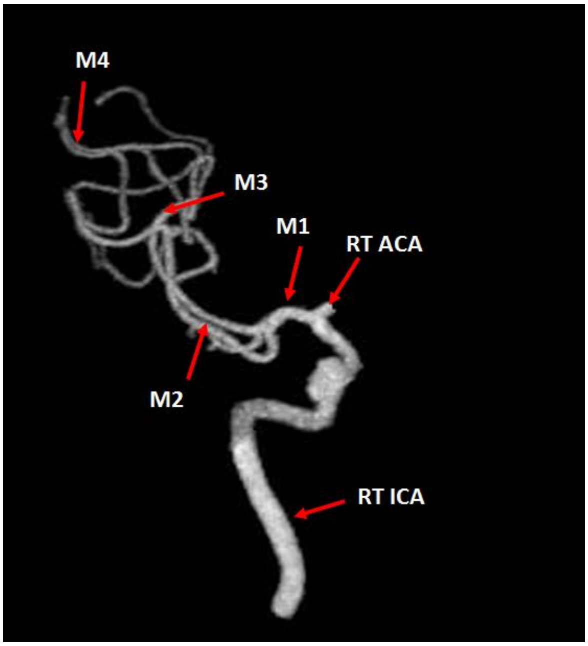

Fig. (5): CTA, 3DVR of the right ICA & MCA (ACA is cut off), AP view. (Image from Radiology department, Ain Shams University).