Role of Multidetector CT (MDCT) in imaging of acute stroke

ESSAY

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سورة النمل

بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

رَبِّ أَوۡزِعۡنِيٓ أَنۡ أَشۡكُرَ نِعۡمَتَكَ ٱلَّتِيٓ
أَنۡعَمۡتَ عَلَيَّ وَعَلَىٰ وَٰلِدَيَّ وَأَنۡ أَعۡمَلَ
صَٰلِحٗا تَرۡضَىٰهُ وَأَدۡخِلۡنِي بِرَحۡمَتِكَ فِي
عِبَادِكَ ٱلصَّٰلِحِينَ ١٩

صدق الله العظيم

Dedication

To the soul of my Father (may Allah have mercy on him).
To my ***Mother ..***
To my Sister ..
To my Brother..

I would like to dedicate this Essay to you all . Thank you for your continuous support & help .

Acknowledgment

*First and foremost, thanks to **Allah**, to whom I relate any success in achieving any work in my life.*

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Mohamed Hamed Ammar

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List of Abbreviations

ACA	anterior cerebral artery
AICA	anterior inferior cerebellar artery
BA	basilar artery
BBB	blood-brain barrier
CBF	cerebral blood flow
CBV	cerebral blood volume
CTA	CT-angiography
CTP	CT perfusion
DWI- MR	diffusion weighted magnetic resonance
ECA	external carotid artery
HT	hemorrhagic transformation
ICA	internal carotid artery
IP	ischemic penumbra
MCA	middle cerebral artery
MDCT	multi-detector CT
MTT	mean transit time
NCCT	Non contrast CT
PAO	parent artery occlusion
PCA	posterior cerebral artery
PET	positron emission tomography
PICA	posterior inferior cerebellar artery
PMN	polymorphonuclear
PS	microvascular permeability (expressed as the surface area product)
PWI-MR	perfusion-weighted magnetic resonance
ROI	region of interest

SCA	superior cerebellar artery
SPECT	single photon emission CT
TAC	time-attenuation curves
TTP	time to peak
XeCT	xenon-enhanced CT

Introduction and Aim of the Work

INTRODUCTION

Stroke is the second leading cause of death in the world , with approximately 6.2 million deaths per year from stroke or another form of cerebrovascular disease (***WHO.,*** **2011**).

Stroke is a syndrome caused by disruption of the blood flow to part of the brain due to either *(a)* occlusion of a blood vessel (ischemic stroke, seen in approximately 80% of cases); or *(b)* rupture of a blood vessel, resulting in injury to cells and causing sudden loss of focal brain functions. (**de Lucas et al., 2008**).

Imaging in patients with acute stroke should be targeted toward assessment of the four *P*s—parenchyma, pipes, perfusion, and penumbra **(Rowley , 2001)**. This approach enables the detection of intracranial hemorrhage, differentiation of infarcted tissue from salvageable tissue, identification of intravascular thrombi, selection of the appropriate therapy, and prediction of the clinical outcome.(**Srinivasan et al., 2006**).

The only therapy for acute stroke currently approved by the U.S. Food and Drug Administration and the European Union is intravenous thrombolysis with a recombinant tissue-type plasminogen activator called alteplase . However, the benefit of intravenous thrombolysis decreases steadily over time from symptom onset , so that the time window for intervention can be as narrow as 3 hours. Thus, patients must be selected accurately and in a timely manner, since many patients with conditions other than brain ischemia may present with similar clinical findings . Imaging plays a key role by helping exclude hemorrhage or other mimicking lesions. (**de Lucas et al., 2008**).

While acute infarcts may be seen early on conventional MR images, diffusion-weighted MR imaging is more sensitive for detection of hyperacute ischemia. Gradient-echo MR sequences can be helpful for detecting a hemorrhage. The status of neck and intracranial vessels can be evaluated with MR angiography, and a mismatch between findings on diffusion and perfusion MR images may be used to predict the presence of a penumbra. The information obtained by combining various imaging techniques may help differentiate patients who do not need intravenous or intraarterial therapy from those who do, and may alter clinical outcomes **(Srinivasan et al., 2006)**.

The use of computed tomography (CT) for stroke evaluation has progressively increased, since magnetic resonance (MR) imaging is less widely available than CT, and its usage in the acute stroke setting can be hampered by contraindications (such as cardiac prostheses) or confused patient status (**Warren , et al. 2010**) .In addition, CT is fast and is easily performed in severely ill patients who are dependent on support and monitoring devices (**de Lucas et al., 2008**).

Modern CT survey, consisting of three elements: non-contrast CT (NCT), CT-angiography (CTA) and perfusion-CT (PCT). NCT is still the primary imaging modality following acute stroke due to its wide availability. CTA can define the occlusion site, illustrate arterial dissection, grade collateral blood flow, and characterize atherosclerotic disease ***(Wintermark, 2005).***

CT perfusion is critical in determining the extent of irreversibly infarcted brain tissue and potentially reversible penumbra. This is of great importance for patient selection before thrombolytic therapy. CT perfusion also can predict the clinical outcome of patients with acute stroke . ***(Meuli, 2004).***

Aim Of Work

The aim of this study is to illustrate the role of different C.T. modalities in the assessment of the acute cerebral stroke in short time helping the clinicians toward early detection, accurate assessment and better management leading to marked decrease in morbidity and mortality rates of stroke.