

Assessment of Magnetic Resonance Imaging Role in Diagnostic of Brain Infarction

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Abstract: This study was carried out to assess the Magnetic Resonance Imaging (MRI) role in diagnosis of brain infarction among Sudanese at Khartoum, This study was done at Alzaiem Alazhari University-College of Graduate Studies and Omdurman military hospital and modern medical center, Khartoum, Sudan. This was a descriptive quantitative an observational cross-sectional study of 100 Sudanese patients admitting to all flowing hospitals for brain MRI scan, 50 female and male 50 their ages ranged between [18-80] years,. MRI studies were performed using 1.5 Tesla Toshiba whole body MRI machine. The results of this study revealed that the most common affected site of the lesions was left side, 5 patients [18-27] years, the mean size of brain infarction was [2.20 ± 0.46] mm. In 4 patients [28-37] years, the mean size was [3.30 ± 0.35] mm. In 14 patients [38-47] years, the mean size was [4.30 ± 0.26]. In 19 patients [48-57] years, the mean size was [5.36 ± 0.32] mm. In 29 patients [58-67] years the mean size was [6.24 ± 0.30] mm. In 20 patients [68-77] years the mean size was [7.16 ± 0.29] mm. and in 4 patients [78-87] years, the mean size was [7.97 ± 0.12] mm. The present study concluded that there is a strong correlation between infarction size and age, as age increase the infarction size increase, the right side of the brain is more common site for infarction than the left one.. All four imaging sequence of MRI (T1, T2, FLAIR and DWI) have the same signal intensity for infarction appearance, the result of the study was in line with previous studies.

Keywords: MRI, Stroke, Perfusion, ischemic attack

1. Introduction

When Stroke is the third leading cause of death and the leading cause of permanent disability and disability adjusted loss of independent life-years in Western countries.¹ Presently, the only specific, approved therapy for acute ischemic stroke is IV tissue plasminogen activator (tPA) given within 4.5 hours.²⁻⁶ tPA use has been limited due to the short treatment window, concerns about the limitations of CT-based diagnosis, and fear of hemorrhagic risks.

Non contrast CT is the current diagnostic standard for acute stroke due to its wide availability and presumed near-perfect sensitivity for acute intracerebral hemorrhage (ICH),^{7,8}. The most important differential diagnosis to ischemic stroke. For ischemic infarction, a number of early signs have been described⁹, and formalized CT scores have been developed.¹⁰ The sensitivity of CT in acute ischemic stroke varies, depending on the imaging features of infarction, examination time from clinical onset, study population, and other variables.

Sensitivity estimates range from 12% to 92%, with an overall estimate of 40%–60% for the 6-hour time window.¹¹ A post hoc analysis of the CT data from the National Institute of Neurological Disorders and Stroke tPA study yielded a 31% sensitivity for early infarct signs.¹²

Despite the fact established by formal assessment of the evidence relative to an independent standard, CT has become

the de facto diagnostic standard.

As non-contrast CT has limited sensitivity for the diagnosis of ischemic stroke in the initial hours, improved accuracy of stroke diagnosis is necessary for the development and application of optimal thrombolytic and other stroke therapy.^{12,13} New MRI techniques such as diffusion-weighted imaging (DWI).

And perfusion-weighted imaging (PWI) add another dimension to diagnostic imaging^{14,15} and have the potential to improve the diagnostic yield while being practical and feasible.

DWI measures the net movement of water in tissue due to random (Brownian) molecular motion of water and shows hyper intense ischemic tissue changes within minutes to a few hours after arterial occlusion due to a reduction of the apparent

Diffusion coefficient (ADC).^{16,17}. The ADC reduction occurs primarily in the intracellular space associated with disruption in membrane ionic homeostasis

And cytotoxic edema. Decreases in the ADC and increased signal on DWI studies in many instances represent irreversible ischemia. To differentiate acute from subacute or older lesions (T2 shine-through), DWI is used in conjunction with T2-weighted images and ADC maps.

PWI allows the measurement of capillary perfusion. The method most commonly used in clinical practice and research is the dynamic susceptibility contrast-enhanced technique, in which paramagnetic contrast agent is injected as an IV bolus and the signal change is tracked by susceptibility-weighted, T2*-weighted magnetic resonance (MR) sequences.¹⁸ Relative cerebrovascular hemodynamic measures reflecting cerebral blood volume, mean transit time, time to peak, and cerebral blood flow (CBF) can be derived from the MR signal intensity-over-time curve in a semi quantitative fashion. Parameter maps display the area of critically reduced perfusion.

Although studies have overcome the usual logistical obstacles to the emergency use of MRI,^{19, 20}

As there is no true imaging gold standard for acute ischemic stroke that has been established by comparison with neuropathologic findings,²¹ the reference diagnosis of ischemic stroke in most MRI studies is established using a follow-up lesion on CT or conventional MR images consistent with the clinical syndrome and a comprehensive diagnostic workup.

The brain injuries caused by strokes are a major cause of adult disability in the United States. Someone has a stroke every 53 seconds. Someone dies of a stroke every 3 minutes. Older people are most at risk of having strokes, although they can happen at any age including in children and stroke is more common in men than in women²².

A CT scan or MRI of the head is typically the first test performed. MRI (Magnetic resonance imaging) is a test that uses a magnetic field and pulses of radio wave energy to make pictures of organs and structures inside the body. In many cases, MRI gives different information about structures in the body than can be seen with an X-ray, ultrasound, or computed tomography scan. MRI also may show problems that cannot be seen with other imaging methods. Magnetic resonance imaging device offers stunning images of the brain, spine, and soft tissues located around joints²³.

Diffusion-weighted magnetic resonance imaging provides image contrast that is different from that provided by conventional magnetic resonance techniques. It is particularly sensitive for detection of acute ischemic stroke and differentiation of acute stroke from other processes that manifest with sudden neurologic deficits. Because stroke is common and in the differential diagnosis of most acute neurologic events, diffusion-weighted magnetic resonance imaging should be considered an essential sequence, and its use in most brain magnetic resonance studies is recommended²⁴.

2. Material and Method

This was a descriptive quantitative an observational cross-sectional study of 100 Sudanese patients admitting to all flowing hospitals for brain MRI scan , 50 female and male 50 their ages ranged between [18-80] years.

The study was conducted at Khartoum state in Magnetic Resonance Imaging (MRI) department of Omdurman military hospital and modern medical center in the period from April 2016 until April 2017.

Inclusion criteria: Any patient with brain infarction.

Exclusion criteria of the study cases: Patients with normal finding or other brain abnormalities.

Study variables include (Age, Sex, Clinical history, Magnetic Resonance Imaging (MRI) findings

Data was collected using data collection sheet and analyzed using SPSS (Statistical package for Social Sciences).

Magnetic Resonance Imaging (MRI) machine 1.5 Tesla Toshiba made in Japan

MRI Techniques:

Coil used: head coil

Sequence: sagittal T1 / axial T2, flair T2, axial T1, Diffusion weighted image DWI

Patient was in supine position and Metal object were removed (e.g. coin and keys) prior imaging.

All of images were interpreted by radiologist .

3. Result Presentation

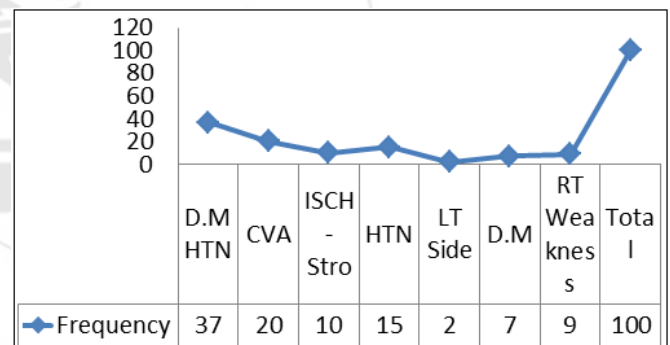


Figure 1: Show frequency distribution for Clinical History among all patients load current (amperes)

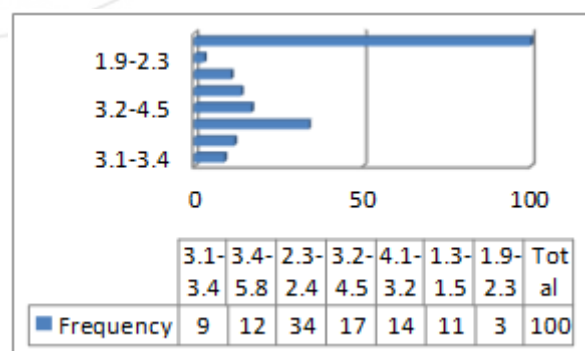


Figure 2: Figure 4.3 show frequency distribution of Size T1 for all patients

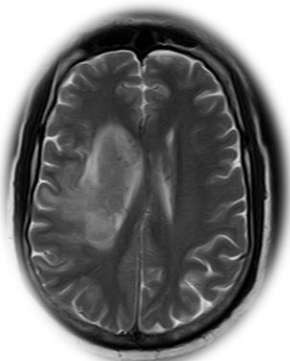


Figure 3: Shows MRI Brain of 57 Years m Female

C/O: Left side weakness revealed Large right capsular area showing mixed low and high signals, surrounding by oedema is contend consistent with acute haemorrhagic infract.The infarct compresses the body of right lateral ventricle and causes midline shift to left side.

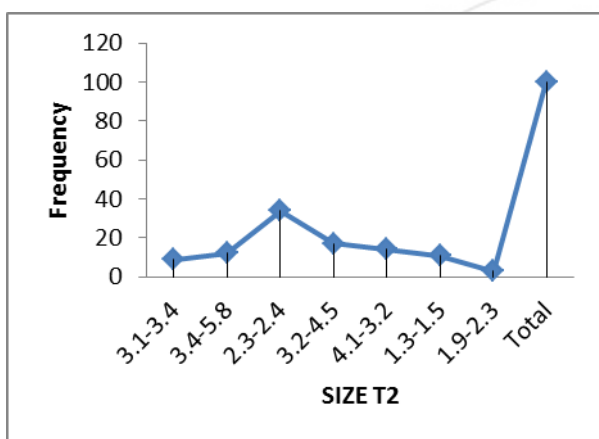


Figure 4: Shows frequency distribution of Size T2 for all patients

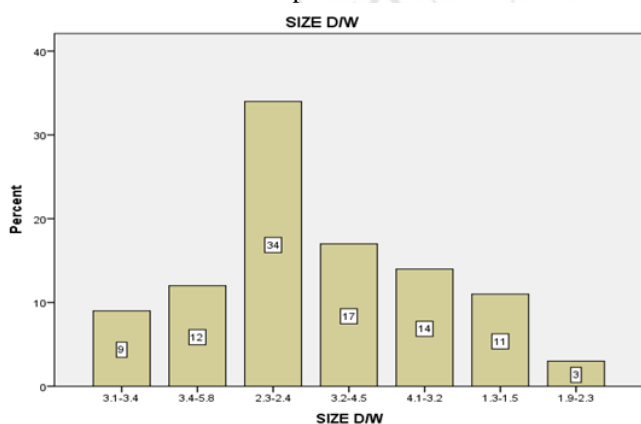


Figure 5: Shows frequency distribution of Size D/W for all patients

Table 1: Shows frequency distribution of age group

Age Group	Frequency
18-27	5
28-37	4
38-47	14
48-57	19
58-67	29
68-77	20
78-87	4

Table 2: Shows distribution of size vs. age group

Age Group	Mean	SD
18-27	2.2	0.46
28-37	3.3	0.35
38-47	4.3	0.26
48-57	5.36	0.32
58-67	6.24	0.30
68-77	7.16	0.29
78-87	7.97	0.12

4. Discussion

This study was carried out to assess the Magnetic Resonance Imaging (MRI) role in diagnosis of brain infarction among Sudanese at Khartoum, This study was done at AlzaiemAlazhari University-College of Graduate Studies and Omdurman military hospital and modern medical center, Khartoum, Sudan. This was a descriptive quantitative an observational cross-sectional study of 100 Sudanese patients admitting to all flowing hospitals for brain MRI scan , 50 female and male 50 their ages ranged between [18-80] years,. MRI studies were performed using 1.5 Tesla Toshiba whole body MRI machine. The results of this study revealed that the most common affected age group included 29 patients [58-67] years with mean size was [6.24 ± 0.30] mm. There is a strong correlation between infarction size and age, as age increase the infarction size increase, the right side of the brain is more common site for infarction than the left ..All four imaging sequence of MRI (T1, T2, FLAIR and DWI) have the same signal intensity for infarction appearance, the result of the study was in line with previous studies From these results there is a correlation between infarction size and age, as age increase the infarction size increase. Finding of this study agree with finding of the study done by Sanak D, et al ²⁵ and Abdelaziz I et al ²⁶

5. Conclusion

This study concluded that Magnetic Resonance Imaging (MRI) allows accurate diagnosis of the infarct lesion with any signal intensity imaging.

Magnetic Resonance Imaging (MRI) allows accurate diagnosis of the infarct lesion, detection of cerebral arterial occlusion or significant stenosis with evaluation of actual collateral flow and may also display certain reversible ischemic changes.

Cerebral infarctions are more frequent in older patients, so the clinical positive case should be referred for MRI. From the study there is a strong correlation between infarction size and age, as age increase the infarction size increase. Further studies are needed to confirm the results acquired with this study for brain infarctions with more data collections.

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