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Evaluation of MRI Protocol for Acute Stroke

KEYWORDS

MRI, stroke, protocol

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ABSTRACT 30 patients of different ages (12 males and 18 females) were selected from Al Amal National Hospital –diagnostic center for evaluation of MRI protocol in acute stroke. Objective: to evaluate MRI protocol in the diagnosis of acute stroke. The study showed that the stroke patients participated in this study, patients with old ages were more affected than younger patients. The preliminary investigations showed most of patients were presented with other diseases such as hypertension and diabetes mellitus .The preliminary investigations obtained from this study revealed that among the patients participated in this study; men were more affected than women in regards with stroke disease. In this study data indicated that both obesity and weight gain in males and females were important risk factors for ischemic and smoker patients. The study concluded that the 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. MRI is better for the detection of acute ischemia, and can detect acute and chronic hemorrhage; therefore it should be the preferred test for accurate diagnosis of patients with suspected acute stroke.

1. Introduction: Since the discovery of x-rays by W C Roentgen in 1895, medical imaging has contributed significantly to progress in medicine; diagnostic imaging has grown during the last 50 years from a state of infancy to a high level of maturity, and become having an important role in patient management, and especially radiologic diagnosis (Herman2009). Magnetic resonance imaging (MRI) is a test that uses a magnetic field and pulses of radio wave energy to take pictures of the head. In many cases, MRI gives information that can't be seen on an X-ray, ultrasound, or computed tomography (CT) scan. The application of magnetic resonance imaging has evolved rapidly since its clinical development in the early 1980s. Presently, examinations of the brain are the second most commonly requestedMR study following spine examinations (Radiology Dept Statistics, 2001), (Slichter 1978).MRI is becoming one of the most important diagnostic tools in clinical decision making for the treatment and management of acute and chronic stroke. Diffusion- weighted imaging (DWI) in which image contrast is based on water motion is remarkably sensitive to ischemic brain injury whereas other conventional imaging techniques such as CT and T1 and T2 MRI fail to detail such injury for at least a few hours, the anatomical mismatch between DWI and perfusion-weighted imaging (PWI) abnormality is indicative of tissue at risk that is potentially salvageable and is the primary target for therapeutic intervention .In addition to DWI and PWI, there are many exciting MRI modalities (such as diffusion tensor imaging, blood– brain barrier permeability imaging, pH MRI(Slicht er 1978).

For an MRI of the head, the head is introduced inside a special machine (scanner) that has a strong magnet. The MRI can show tissue damage or disease, such as infection or inflammation, or a tumor, stroke , or seizure . Information from an MRI can be saved and stored on a computer for more study. Photographs or films of certain views can also be made. In some cases,

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contrast material may be used during the MRI to show pictures of structures more clearly. The contrast may help show blood flow, look for some types of tumors, and show areas of inflammation(Marks et al 1996).Magnetic Resonance Imaging (MRI) of the head is done to look for the cause of headaches ,help diagnose a stroke or blood vessel problems in the head. Problems with blood vessels may include an aneurysm or abnormal twisted blood vessels that are present at birth ; this is called an arteriovenous malformation [AVM), check blood flow or blood clots to the brain, check symptoms of a known or suspected head injury, check symptoms such as change in consciousness, confusion, or abnormal movements . These symptoms may be caused by brain diseases, such as Huntington's disease, multiple sclerosis (MS) ,Parkinson's disease, or Alzheimer's disease ,check for "water on the brain" (hydrocephaly) look for tumors , infections, an abscess, or conditions of the brain or brain stem, such as encephalitis or meningitis, check the eyes, the nerves from the eyes to the brain, the ears, and the nerves from the ears to the brain , look for problems of the pituitary gland, investigate or follow a finding seen on another tests. (Nitz & W. R. 1999).

2. Materials and Methods

2.1 Materials : 2.1.1 Patients This study was a practical in nature, which included a sample of 30 patients in different genders and age groups who were referred to the radiology department in Modern Medical Centers in Khartoum with a suspected case of acute stroke, and had undergone MRI examinations, to evaluate each type of stroke according to their location. Children and patients with brain tumors were excluded from the study, a consent form for each patient was obtained before the exam and their information were used in this study, the data were collected and interpreted by radiologists.

2.1.2 Machines used: The machines used in this study were MRI scanner PHILIPS (1.5tesla) and TOSHIBA (1.5 tesla).
2. 2.1 Techniques used: The following MRI techniques were used:

T1-weighted imaging (T1-WI) in which cerebrospinal fluid (CSF) had a low signal intensity in relation to brain tissue and appeared dark, T2-weighted imaging (T2-WI) in which CSF had a high signal intensity in relation to brain tissue and appeared bright, spin density–weighted imaging in which CSF had a density similar to brain tissue.

Gradient echo imaging had the highest sensitivity in detecting early hemorrhagic changes
In diffusion-weighted imaging (DWI), the images reflected the microscopic random motion of water molecules

2. 2.2 Data Interpretation: All MRI images were studied for signal intensities in different weighted images, and the differentiation of stroke causes, size and locations and radiologistreportswereconsidered.

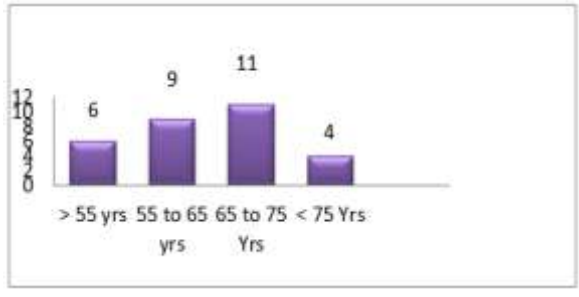
2. 2.3 Data collection: Data were collected from findings which appeared in different MRI cuts axial, sagittal and coronal planes and the data were represented in tables and graphs. The data included the general patients variables (Age, genders and weight) together with the relevant symptoms and clinical information such as clinical signs (A numb or weak feeling in the face, arm or leg, trouble in speaking or understanding ,unexplained dizziness, blurred or poor vision in one or both eyes, loss of balance or an unexplained fall, , headache (usually severe or of abrupt onset) or unexplained change in the pattern of headaches, confusion), the risk factors and patients history were also included (hypertension, D.M , heart disease).

2. 2.4 Data analysis: All data were analysed using Microsoft Excel and statistical package for social sciences(SPSS) version 22. Statistical analysis included frequency tables, graphs, cross tabulation and t test to compare the variables. The difference was considered significant when p-value is less than or equal to 0.05.

3. Results: In the present study, a total number of 30 patients with stroke were studied to assess the role of MRI scanning in diagnosing stroke.

Table (1) illustrates the frequency of Stroke patient's according to the age

Age	frequency
> 55 yrs	6
55 to 65 yrs	9
65 to 75 yrs	11
< 75	4
Total	**30**



Figures (1) illustrates the frequency of Stroke patients according to the age.

Table (2) illustrates the frequency of Stroke patients according to the gender.

Gender	frequency
Male	18
Female	12
Total	**30**

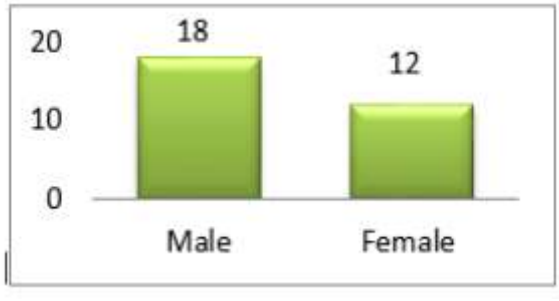


Figure (2) illustrates the frequency of Stroke patients according to the gender.

Table (3) illustrates the frequency of Stroke patients according to the weight.

weight	frequency
>76 kg	15
76 to 80 kg	10
< 80 kg	5
Total	**30**

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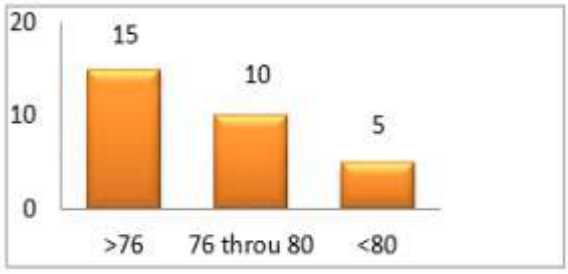

Figure (3) illustrate the frequency of Stroke patients according to the weight.

Table (4) illustrates the correlation between Stroke patients and their habits.

Habits	Frequency	Percentage %
Smoker	21	70.0%
Non smoker	9	30.0 %
Total	**30**	**100.0 %**

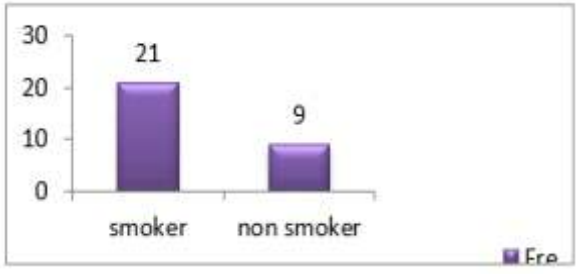

Figure (4) shows the Frequency of Stroke patients according to their habits.

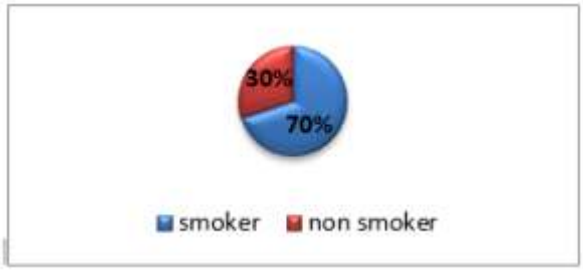

Figure (4) shows the Percentage % of Stroke patients according to their habits.

Table (5) illustrates the percentage % of Stroke patients according to the final diagnosis.

Final diagnosis	percentage %
Heamorrhage	30 %
Ischemia	52 %
Heamorrhage and ischemia	*6.7 %*

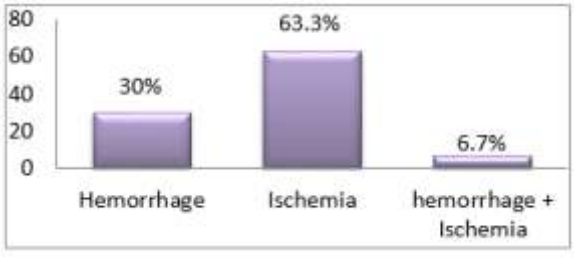

Figure (5) illustrates the percentage % of Stroke patients according to the final diagnosis

Table (6) represents the frequency and percentage % of the common site of stroke.

Site of stroke	frequency	Percentage%
RT Anterior	2	6.7 %
RT Posterior	1	3.3 %
LT Anterior	2	6.7 %
LT Posterior	3	10.0 %
Preivenricular	19	63.3 %
LT Anterior + Preiventricular	2	6.7 %
LT Anterior + LT Posterior	1	3.3 %

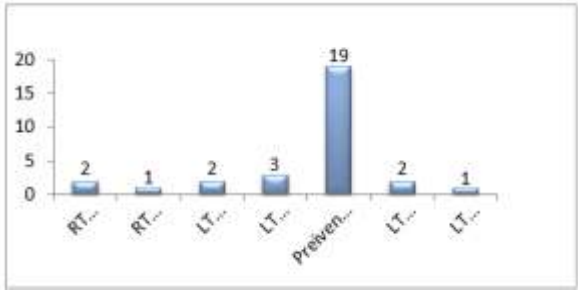

Figure (6) represents the frequency of the common site of stroke.

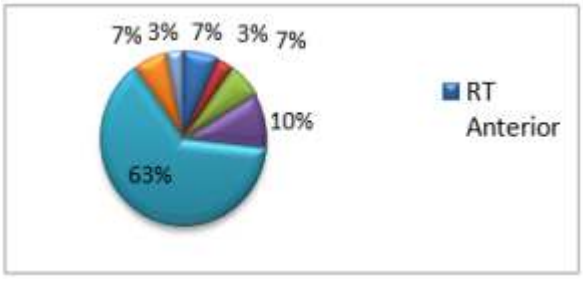

Figure (6) represents the percentage % of the common site of stroke

Table (7) shows the effect of age on Stroke patients (P value 0.426). (P. vlaue > 0.05.)

Final Diagnosis * age Cross tabulation							
			age				Total
			>55	55-65	65-75	<75	
Final Diagnosis	Ischemia	Count	3	5	8	3	19
		% within Final Diagnosis	15.8 %	26.3 %	42.1 %	15.8 %	100.0 %
		% within age	50.0 %	55.6 %	72.7 %	75.0 %	63.3%
	hemorrhage	Count	3	3	3	0	9
		% within Final Diagnosis	33.3 %	33.3 %	33.3 %	0.0%	100.0 %
		% within age	50.0 %	33.3 %	27.3 %	0.0%	30.0%

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	Ischemia+ Hemorrhage	Count	0	1	0	1	2
		% within Final Diagnosis	0.0%	50.0 %	0.0%	50.0 %	100. 0%
		% within age	0.0%	11.1 %	0.0%	25.0 %	6.7 %
Total	Count	6	9	11	4	30	
	% within Final Diagnosis	20.0%	30.0 %	36.7 %	13.3%	100.0%	
	% within age	100.0%	100. 0%	100. 0%	100.0 %	100.0%	

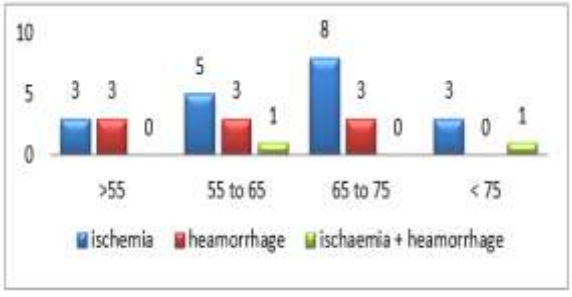

Figure (7) shows the effect of age on Stroke patients

Table (8) shows the Cross tabulation between final diagnosis and gender

Final Diagnosis * Gender Cross tabulation				
		Gender		Total
		Male	Female	
Final Diagnosis	Ischemia	14	5	19
	hemorrhage	3	6	9
	Ischemia+ Hemorrhage	1	1	2
Total		18	12	

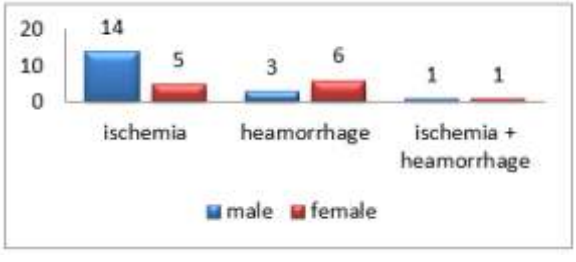

Figure (8) shows the Correlation between final diagnosis and gender.

Table (9) shows the Cross tabulation between final diagnosis and weight.

Final Diagnosis * wt Cross tabulation				
Final Diagnosis	wt			Total
	>76 kg	76 to 80 kg	<80kg	
Ischemia	7	8	4	19
hemorrhage	7	1	1	9
Ischemia+ Hemorrhage	1	1	0	2
Total	15	10	5	30

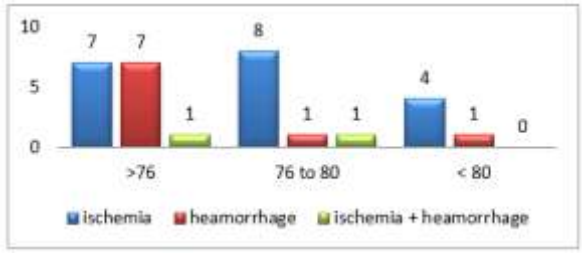

Figure (9) shows the frequency of weight on Stroke patients

Table (10) shows the correlation between final diagnosis and patient history.

final diagnosis	Disease			Total
	DM	HT	DM + HT	
ischemia	1	11	7	19
hemorrhage	0	3	6	9
ischemia + hemorrhage	0	1	1	2
Total	1	15	14	30

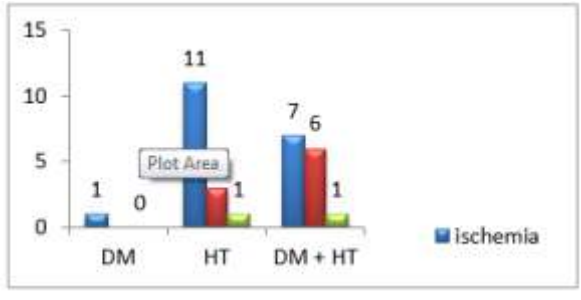

Figure (10) shows the correlation between final diagnosis and patient history.

4. Discussion: The preliminary investigations obtained from this study revealed that the patients with old ages were more affected by stroke than younger patients. This result were consistent with (H. P. Adams Jr. et al 2007), who postulated that the risk of stroke rises significantly with age. After the age of 55 year, the occurrence of stroke is more than doubles with each passing decade. Each year, about 1 percent of people between ages 65 and 74 have a stroke and 5 to 8 percent of people in that age group who have had a TIA go on to stroke. Although the risk associated with advancing age cannot be changed, it is an important factor in assessing stroke risk and planning preventive therapies.

The preliminary investigations obtained from this study revealed that among the patients participated in this study; men were more affected than women in regards with stroke disease. Although this study included only 18 males and 12 females, however, its results were consistent with the remarks reported by (Kajstra J et al 1996), who postulated that the risk of stroke rises in males than females, among 1,110 patients, including 615 men and 505 women, a normal or near normal outcome at 90 days was found in 37.1% of men vs. 36.0% of women, but disagreed with (Dr David M. Kent 2011), who found In his pooled analysis of acute ischemic stroke that strokes usually have greater effect on women than men because women have more events and are less likely to recover.

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In this study, data indicated that both obesity and weight gain in males and females were important risk factors for ischemic and total stroke but not hemorrhagic stroke. The relationship between obesity and total stroke depends on the distribution of stroke subtypes in the population. This result was in agreement with the findings of (P. D. Schellinger 2010), on his study which included 403 ischemic strokes patients and 269 hemorrhagic strokes patients whose weights were ≥27 kg/m2 and who had significantly increased risk of ischemic stroke, with relative risks (RRs) of 1.75 (95% confidence interval [CI], 1.17-2.59) for BMI of 27 to 28.9 kg/m2; 1.90 (95% CI, 1.28-2.82) for BMI of 29 to 31.9 kg/m2; and 2.37 (95% CI, 1.60-3.50) for BMI of 32 kg/m2 or more (P for trend<.001), as compared with those with a BMI of less than 21 kg/m2. The preliminary investigations obtained from this study revealed that the smoker patients were more affected than non smoker patients, and this result was reached by (Lancaster T, Stead L (2005), who reported that smoking facilitates atherosclerosis and appears to be a dependent risk factor for strokes that result from a clot. It also seems to be a risk for strokes that result from cerebral hemorrhage. Men in a community studied extensively for cardiovascular disease who smoked more than 40 cigarettes a day had twice the stroke risk of men who smoked fewer than 10. In a large Harvard Medical School study of women, the number of cigarettes smoked was found to be directly related to stroke risk. Women smoking more than 25 cigarettes a day had a 2.7 times greater risk of stroke from a clot or embolus and a 9.8 times greater risk of a hemorrhagic stroke. Data from both the Framingham Heart Study and the Honolulu Heart Study indicated that one can significantly reduce stroke risk by stopping smoking. Five years after they stop, smokers have a stroke risk equal to that of non-smokers (National Institute for Health and Clinical Excellence 2011).In this study the result of final diagnosis in stroke patients, revealed that the percentage of ischemia is more than hemorrhage in the sample of study, in which the ischemia was 63.3% and hemorrhage was 30%.One of the most interesting observations obtained from this study is to identify the common site of stroke, the result showed that the percentage of stroke in Preiventricular was 63.3% from total number of study sample.

5.Conclusion: Cerebral ischemia triggers an extremely complex set of pathophysiologic events. MRI provides information on almost all the elements taking part in this setting, from cerebral tissue itself to blood vessels and blood flow dynamics, and helps us to get a grasp of this dynamic process. The development of tissue and clinical-based prediction models relying on MRI not only provide the clinician with prognostic data, but also help in optimizing patient selection of stroke therapies. The automated lesion- outlining and volume calculation software currently present in some clinical workstations is a major step forward in individualization of stroke care. However, despite its advantages, MRI by itself cannot supply all the information needed to make accurate predictions, and ideal prognostic models should consist of a combination of clinical and imaging data.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. However, the main objective for MRI still remains: improvement of non-invasive rapid and accurate identification of brain tissue at risk for infarction, which may be salvaged by safe and effective reperfusion therapy.MRI is better for detection of acute ischemia, and can detect acute and chronic hemorrhage; therefore it should be the preferred test for accurate diagnosis of patients with suspected acute stroke. The greater overall sensitivity of MRI for acute stroke in this study is attributable to its electiveness for detection of acute ischemic stroke.

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