

Evaluation of Cerebral Infarction in Diabetic Patients with the history of Hypertension on Magnetic Resonance Imaging

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ABSTRACT

Background: Mortality rate of individual in later age is increasing due to Cerebral infarction among the diabetic and hypertensive patients that leads towards the complexity within the patients. This study Considered to determine Cerebral Infarction in Diabetic patients with the history of hypertension on Magnetic Resonance Imaging.

Aim: To Determine the Evaluation of Cerebral Infarction in Diabetic Patients with the history of Hypertension on MRI

Duration of study: 01-May-2021 to 01- September-2021

Methodology: The study will be supervised in 162 Diabetic as well as Hypertensive patients comprising Genders for evaluation cerebral infarction through MRI.

Results: In our study different groups of patients formed on the basis of their age and calculated the minimum and maximum age of the patients which are 41years and 91years respectively out of 162 patients. Also calculated the mean age as well as the value of standard deviation among the patients which is 67.35 and ± 8.905 respectively. Different groups of patients also formed on the basis of their gender and also calculated their frequency 77 males and 85 females as well as percentages 47.5% males and 52.5% females. Based on data calculated the single infarction 27(16.7%) multiple infarction 48(29.6%) and also calculated the frequency and percentage of collectively patients appeared with the cerebral infarction 75(46.3%) and in which cerebral infarction absent 87(53.7%) out of 162 Patients.

Conclusion: It is conducted a Survey on minute level and observed all the data related to cerebral infarction and concluded that the MRI is the good imaging device for the evaluation of Cerebral Infarction. It provides a pattern which ideal designate tried with likewise exploration as well as assessment upon a Larger population.

Keywords: Cerebral Infarction, DWI, PWI, Hypertension, Magnetic Resonance imaging, Diabetes mellitus

INTRODUCTION

The prevalence of cerebral infarction among hypertensive patients is 12%¹. The cerebrum is made of bilaterally-symmetrical hemispheres. Cortex is the outer layer and it is arranged in convulsions that is deep irregularly shaped sulcus. This is the grey matter of the Brain. Below the cortex lies nerve fibers or white matter².

The lobes of cerebral hemisphere lie on top of frontal lobes which construct an anterior portion of each hemisphere and are given names after the bones of skull. It controls permissive muscular functions such as moods, aggression, and motivation. The main sulcus divides the brain into different lobes that are parietal lobe from the front lobe. It controls pain-related sensory information like temperature, taste and touch, taste and temperature. Different lobes of the brain like temporal, parietal and frontal are separated by the side fissure. It evaluates smell, hearing input and is involved with memory process. It also acts as theoretical thought and judgment decision. Back of each hemisphere is formed by occipital lobe, it acts as receiving and interpreting visual inputs. The insula which is the fifth lobe is embedded deep in lateral sulcus³.

Cerebral infarction is the 2nd major reason of mortality because of its severe development, fast deterioration as well as stark cerebral edema complications⁴. Imaging is currently the utmost dependable policy for Cerebral Infarction Therapy. Diagnosis has progressive from customary morphology to the mix structure as well as function by development of modern medical procedures as well as imaging technology, in specific progression of MRI⁵. The effect of infarction has occurred in the form dissimilar illnesses like severe anemia, male gender, low hemoglobin, Diabetes, relative hypertension after Parvovirus infection, Laboratory evidence of hyposplenism, prior seizures and comparatively rare pain⁶. The cerebrum's role is to regulate

voluntary movement and to receive and interpret sensations of consciousness. It is the seat of the sentiment, memory, reasoning, intelligence and moral meaning⁷. Weighted diffusion (DWI) provides an early marker of acute cerebral ischemic⁸. MRI is more prone to cerebral infarction, whereas its effectiveness in emergency treatment is reduced than the CT because it has more potential side effects⁹.

The patterns of CT and MRI are connected with the infarction and identification of the standard of these CT and MRI is not an easy task. It may be difficult for any individual patient to assess the imaging of brain whether it is based on infarction is caused by the specific branch of cortical that is MCA and in the form of occlusion or by hypo-perfusion induced by an existing ICA disease¹⁰. Cerebral ischemia's imaging presentation varies considerably over time. At the moment, MRI can detect tiny infarctions. MR brain imaging is much more susceptible to acute infarction by CT imaging. A greater morning BP surge in elderly hypertensives is correlated with the danger of stroke regardless of fall in the BP of different type like AMBP and nocturnal along with the infarction is caused in a silent way as patient is not able to detect. The operation of brain by the MRI, a magnet with superconducting nature and its primary force is approximately 0.35. An SCI was described on T1-weighted pictures as the region having signal with low intensity (2 to 14 mm), which was also noticeable on T2-weighted illustrations as a hyperintense lesion. Multiple SCIs have been characterized as 2 infarcts or more. It is observed that the size range of lacunar infarct of all SCI was < 15 mm¹¹.

IWS infarcts were split into two forms like confluent and partial infarcts and the split of this infarct due to their appearance in radiological way¹². Confluent infarcts massive cigar-fashioned along the ventricles, while partial water shed infarcts can also additionally have seen both as a one lesion or chain-like (rosary-shape) in CSO. Medullary infarcts due to stenosis of medullary arteries arising from pail plexus¹³.

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Diffusion-weighted images of MRI increase the quality and the capability to diagnose acute cerebral infarction in terms of both real extent and localization. MRI can also provide help to detect substantial cerebral arterial clogging or extreme stenosis.¹⁴. DWI and PWI are effective new strategies of MRI for the evaluation of acute cerebral ischemia¹⁵. MR diffusion-weighted imaging (DWI) suggest acute ischemic lesions early after stroke¹⁶.

The objective of the study was to determine the evaluation of cerebral infarction in diabetic patients with the history of hypertension on MRI

MATERIAL AND METHODS

It was a descriptive study carried out in department of Radiology; Bashir Neurospine Institute (BNI) located in Lahore city after approval from Ethical Committee. The duration of study is 4 months. Sample size was 162. Both male and female subjects were enrolled for examination on MRI Siemens 0.35T Magnetom. The subject lying approach is used that is in the supine position. In this regard, to have access the Cerebral infarction head scan were acquired by MRI. Diabetes was diagnosed to the patients by several tests including A1C test, plasma glucose test it is done either in Fasting plasma glucose form or the 2-hour plasma Glucose form after meal. Hypertension was also diagnosed to patients in the sitting position. Data that is collected from the research methodology is stored in Excel file along with SPSS software and sheets for data collection was also used in the statistical analysis after applying in tests. In this research, scientific research method is used and the recent articles are used in the collection of information. The proper citation was also done and references were also added in the last chapter of research.

RESULTS

In our study different groups of patients formed on the basis of their age and calculated the minimum and maximum age of the patients which are 41years and 91years respectively out of 162 patients. Also calculated the mean age as well as the value of standard deviation among the patients which is 67.35 and ±8.905 respectively. Different groups of patients also formed on the basis of their gender and also calculated their frequency 77 males and 85 females as well as percentages 47.5% males and 52.5% females. Based on data calculated the frequency and percentages of patients who shows the cerebral infarction and come with vertigo 19(11.7%), Headache 7(4.3%), syncope 11(6.8%), Diabetes mellitus 73(45.1%) respectively. Also a table formed in which patients separated on the basis of cerebral infarction absent or present and also calculated their frequency and percentages, absent infarction 87(53.7%) and present infarction 75(46.3%) respectively. Also differentiated patients on the basis of single or multiple infarction and calculated their frequency and percentages as well, single infarction 27(16.7%) multiple infarction 48 (29.6%) and also calculated the frequency and percentage of collectively patients appeared with the cerebral infarction 75 (46.3%). The results described that 75 (46.3%) patients diagnosed with Cerebral Infarction activated through diabetes as well as hypertension and they may be reason of Cerebral Infarction as well as may prime to further complication, especially in adults.

Table 1: Cross Table of diabetes Mellitus with Gender

Gender	Diabetes Mellitus		Total	
	No	yes		
Female	Count	42	43	85
	% within gender	49.4%	50.6%	100%
Male	Count	47	30	77
	% within gender	61.0%	39.0%	100%
Total	Count	89	73	162
	% within gender	54.9%	45.1%	100%

Table 1 shows 43 (50.6%) Hypertensive Female Patients Having Diabetes Mellitus while 42 (49.6%) hypertensive Female patients were non diabetic. 30(39%) Hypertensive Male Patients Having Diabetes Mellitus while 47(61%) hypertensive Male patients with were non diabetic out of 162 Patients.

Table 2: Frequency of cerebral infarction among patients with diabetes mellitus

Cerebral Infarction		Diabetes Mellitus		Total
		No	Yes	
Absent	Count	64	23	87
	% within cerebral infarction Present/Absent	73.6%	26.4%	100.0%
Present	Count	25	50	75
	% within cerebral infarction - Present/Absent	33.3%	66.7%	100.0%
Total	Count	89	73	162
	% within cerebral infarction - Present/Absent	54.9%	45.1%	100.0%

Table 2 shows 23 Diabetic Patients which is 26.4% Not Having Cerebral Infarction and 64 Non Diabetic patients with 73.6% not Having Cerebral Infarction. 50 Diabetic Patients which is 66.7% Having Cerebral Infarction while 25 Non Diabetic patients which is 33.3% Having Cerebral Infarction. Overall 73 Diabetic Patients which is 45.1% and 89 Non Diabetic patients which is 54.9% out of 162 Patients.

Table 3: MRI Findings and Cerebral Infarction Cross Table

MRI Findings		Cerebral Infarction - Present/Absent		Total
		Absent	Present	
		Confluent infarct	Count	
	% within MRI findings	0.0%	100.0%	100.0%
Hemorrhagic infarct	Count	0	2	2
	% within MRI findings	0.0%	100.0%	100.0%
Ischemic infarct	Count	0	12	12
	% within MRI findings	0.0%	100.0%	100.0%
Lacunar infarct	Count	0	45	45
	% within MRI findings	0.0%	100.0%	100.0%
Maturing infarct	Count	0	6	6
	% within MRI findings	0.0%	100.0%	100.0%
Multifocal infarct	Count	0	5	5
	% within MRI findings	0.0%	100.0%	100.0%
Normal examination	Count	87	1	88
	% within MRI findings	98.9%	1.1%	100.0%
Total	Count	87	75	162
	% within MRI findings	53.7%	46.3%	100.0%

Table 3 shows 75 Diabetic and Hypertensive Patients Are Diagnosed with Cerebral Infarction out of 162 Patients. In which 4 patients which is 100.0% having confluent infarction, 2 patients which is 100.0% having Hemorrhagic infarction, 12 patients which is 100.0% having ischemic infarction, 45 patients which is 100.4% having lacunar infarction, 6 patients which is 100.0% having maturing infarction, 5 patients which is 100.0% having Multifocal infarction. 88 Patients having normal examination.

First of all, a table formed and produced different groups of patients on the basis of their age and calculated the minimum and maximum age of the patients which are 41years and 91years respectively out of 162 patients. Also calculated the mean age as well as the value of standard deviation among the patients which is 67.35 and ±8.905 respectively. Then in the second table the different groups of patients also formed on the basis of their gender and also calculated their frequency 77 males and 85 females as well as percentages 47.5% males and 52.5% females. The data Collected was tabulated in tables, as the purpose of this study is to rule out cerebral infarction in Diabetic and hypertensive patients as it is one of the major cause of mortality among the hypertensive and diabetic patients.

Figure 1: MRI detect the lacunar infarct in the pons on a background patchy moderate old periventricular white matter ischemic changes on T2 weighted sagittal image.

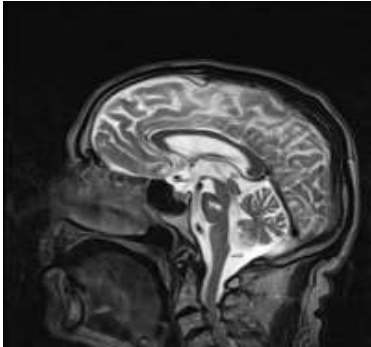


Figure 2 & 3: MRI detect a small acute left cerebellar hemispheric infarct. on left side on DWI image hyperintense area seen shows early detection of infarction. and on right side hyperintense area seen on T2 weighted image shows acute infarct in cerebellar region.

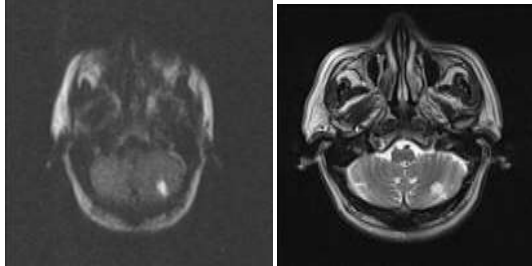
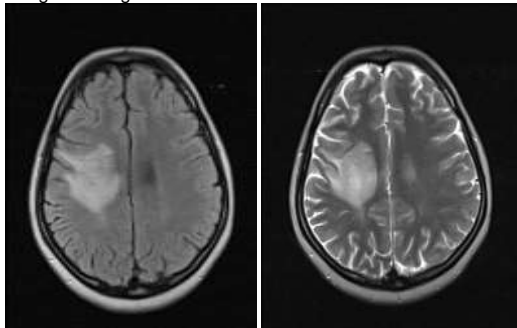


Figure 4 & 5: MRI detect the right Lentiform infarct on right side of image T1 weighted image shows the hyperintense area of infarction and on the right side T2 weighted image shows the Lentiform infarction.



DISCUSSION

It was a concise study on the subject of Diabetic and hypertensive MRI cerebral infarction. This took place in Bashir Neurospine institute, Lahore in 2021 on the population of Lahore. The main purpose of this study is to determine cerebral infarction in Diabetic and Hypertensive patients as it is one of the main causes of death in hypertensive patients, and magnetic resonance imaging provides sufficient data on earlier studies of cerebral infarction using computed tomography to determine cerebral infarction. At that time, the findings obtained by CT & MRI were almost identical, but if we are talking about modern day technology, then MRI has already exceeded the speed and has become the preferred method of brain infarction imaging. The purpose of this research report is to collect data on cerebral infarction in Diabetic and hypertensive patients with MRI. They seek to establish a somewhat acceptable relationship between cerebral infarction and patients with Diabetes and hypertension using magnetic resonance imaging. Despite its importance The majority of the work performed on cerebral infarction is CT although the MRIs are more informative in their images. We examined 77 males and 85 females in the radiology department of Bashir Neurospine Institute Lahore. Population entered

for MRI Head Scan examination was at least 40 years of age and the mean age of patients as well as standard deviation in patients is 67.35 ± 8.905 years.

A study conducted by Reinhold Schmidt and his co-workers and published in 2004 on the topic of Brain diseases in diabetic patients evaluating on magnetic resonance imaging concluded that the diabetes increases the risk of cerebral infarction as well as brain atrophy and periventricular white matter lesion. And they also concluded that the diabetic patients are also at increase the risk of hypertension which can leads to the further complications. They included 1252 patients in their study in which 114 were diabetics and separated diabetic patients on the basis of diabetic treatments and calculated the frequency and percentages of patients who had no treatment is 58(50.9%) and patients who received any pills for diabetes is 47 (42%) and patients who received insulin is 9(0.7%) respectively. Overall 95% cerebral infarction appeared on magnetic resonance imaging among diabetic patients. Study concluded that the MRI shows the cerebral infarction in 9.6% and 29.8% severe subcortical as well as 25.4% periventricular white Matter lesion in diabetic patients. All the patients with diabetes at increase the risk for different types of brain lesion and these changes easily detected on MRI. The findings of this study is comparable with our study to evaluate cerebral infarction in diabetic and hypertensive patients in which all the diabetic patients 73 (45.1%) show the cerebral infarction out of 162 patients on MRI and also associated with the hypertension and overall all the patients appeared with the cerebral infarction 75 (46.3%) were hypertensives. So both hypertension and diabetes can be the major causes of cerebral infarction¹⁷.

According to DA Decker research published in 2018 found that the leading factor of death and disability around the world is due to brain related disorders like hemorrhagic, cerebrovascular. Therefore, different reason of stroke is identified but the most common and prevalent factor is that when disease of cerebrovascular is combined with atherothrombosis. The disease of hypertensive vascular leads to atherosclerosis and arteriosclerosis development and is the leading factor for the hemorrhage and lacunar infarction, both caused by deep penetration artery harm. The findings of this study is comparable with our study in which all the diabetic patients 73 (45.1%) show the cerebral infarction out of 162 patients on MRI those also associated with the hypertension. And also conclusion of this study and our study is comparable that hypertension and diabetes can be the cause of cerebral infarction like lacunar infarct as well other different types of infarction. We calculated the frequency of lacunar infarction in hypertensive and diabetic patients which is 45 (100%) out of 162 patients and conclude that patient with the hypertension at increased the risk of lacunar infarct which can cause further complication¹⁸.

Another research on acute intracerebral hemorrhage reported in 2017 It is a medical emergency with potentially devastating risk of disease. ICH after an ischemic stroke is the second leading type of stroke. Bleeding may result from multiple brain parenchyma etiologies. While other risk factors also exist, hypertension is by far the biggest risk factor for ICH. In our study all the diabetic patients 73 (45.1%) show the cerebral infarction out of 162 patients on MRI those patients also associated with the hypertension and also we found that patients come with severe hypertension at increased the risk of hemorrhage and calculated the frequency and percentage of patients appeared with the hemorrhagic infarct which is 2 (100%) we found that the results of this study is resembles with our study¹⁹.

Another study was conducted as a cause for intracerebral hemorrhage on the topic of hypertension. The study showed that the cases are correlated with samples with and without hypertension from the analysis of blood pressure (n = 16,204) in order to assess relative risk. The relative risk of intracerebral hemorrhage for recurrent hypertension was 3.9 (maximum likelihood of 95 percent, 2.7 to 5.7). The relative risk for the extensive hypertension concept was 5.4 (3.7 to 7.9). Relative risk of black hypertension (4.4), age after 70 (7%), prior cerebral infarction (22%) and diabetes (3%) has also been established. We conclude that the term "hypertensive hemorrhage" should be used very selectively, especially in whites. And propose that hypertension and state that hypertension should be one of the main cause for spontaneous intracerebral hemorrhage. In our study we evaluate cerebral infarction in diabetic and hypertensive patients on MRI in which all the diabetic patients 73 (45.1%) show the cerebral infarction out of 162 patients and all the patients appeared with the different types of infarction 75 (46.3%) was hypertensives so we conclude that hypertension is the main cause of cerebral infarction and due to which

patient presented with the different types of sign and symptoms as well as with the intracerebral bleeding or hemorrhage. So we can classify the infarction which is hemorrhagic, ischemic, lacunar, multifocal, confluent and maturing infarct, which appeared in the hypertensive and diabetic patients. Results of this study resembles with our study results²⁰.

A study conducted in 1994 aimed at evaluating hypertensive cerebral involvement before cerebrovascular accidents. Our selection criteria were observed in 58 and 11 patients with hypertension and borderline hypertension respectively. 15 and 58 patients with cerebral infarction and with normal BP respectively. Researchers have found that in both categories of hypertensive patients the borderline hypertensive patients are greater than those for cerebral infarction. In Patients with no cerebral infarction there are two risk factors those are negatively associated with the cerebrovascular illness including hypertension and age. Study concluded that the hypertension mainly affects the vascular supply of brain and can cause the cerebrovascular injuries and other organs as well. The findings of this study is comparable with us in which all the diabetic patients 73 (45.1%) show the cerebral infarction out of 162 patients and all those patients associated with the hypertension and in our study we conclude that all the patients appeared with the different types of cerebral infarction were hypertensives 75 (46.3%) and came with symptoms like headache, vertigo, syncope as well as without any kind of symptoms. And patients with no symptoms diagnosed mostly with the lacunar infarction²¹.

Other one more study performed in the 2017 file of Osaka University Hospital found that 108 patients had been examined with no stroke record. These included 66 patients with critical hypertension (age 63±9; mean ± SD) and 42 aged normotensive subjects (age 61±9). Careful analysis and thorough neurological tests showed that there were no neurological disorders and signs and history of stroke, including transient ischemic attack. MRI studies were conducted primarily to evaluate non-specific neurological symptoms (i.e., migraine, lightheadedness, dizziness, hypertension. In hypertensive patients, the SCI frequency appears to be higher (47 percent) than normotensive patients (33 percent). The incidence of hypertensive patients increased significantly from 27% in the 1950s, 44% in the 1960s and 87% in the 1970s, whereas there was no significant increase in normotensive patients. The findings of this study is comparable with our study to evaluate cerebral infarction in diabetic and hypertensive patients. In which all the diabetic patients 73 (45.1%) show the cerebral infarction out of 162 patients on MRI and also associated with the hypertension and overall all the patients appeared with the cerebral infarction 75 (46.3%) were hypertensives so hypertension can be the major cause of cerebral infarction²².

According to Ali Guermazi research published in 2003, fast and accurate diagnosis is very necessary, but not so easy since neurological sign and symptoms are specific to diseases. Presenting the characteristic imagery of the central nervous system Neurological imaging with EEG testing, blood and CSF fluid analysis useful for diagnosing many of these complications and differentiating the underlying symptoms of the disorder. The findings of this study is comparable with our study in which patients diagnosed with cerebral infarction 75 (46.3%) were diabetic and hypertensives and easily detected on MRI²³.

In addition, the mean values and standard deviations of the information obtained were shown by our analyzed data. The mean age as well as the value of standard deviation among the patients is 67.35 and ±8.905 respectively out of 162 patients. Based on data calculated the frequency and percentages of patients who shows the cerebral infarction and come with vertigo 19(11.7%), Headache 7(4.3%), syncope 11(6.8%), Diabetes mellitus 73(45.1%) respectively. Also a table formed in which patients separated on the basis of cerebral infarction absent or present and also calculated their frequency and percentages, absent infarction 87 (53.7%) and present infarction 75(46.3%) respectively. Also differentiated patients on the basis of single or multiple infarction and calculated their frequency and percentages as well, single infarction 27(16.7%) multiple infarction 48 (29.6%) and also calculated the frequency and percentage of collectively patients appeared with the cerebral infarction 75 (46.3%). The results described that 75 (46.3%) patients diagnosed with Cerebral infarction activated through diabetes as well as hypertension and they

may be reason of Cerebral Infarction as well as may prime to further complication, especially in adults.

CONCLUSION

It is concluded that there has been no such Illustrious Assessment between hypertensive and diabetic patients appearing the cerebral infarction. According to our study we conducted a Survey on minute level and observed all the data related to Cerebral Infarction in diabetic and hypertensive patients on magnetic resonance imaging and concluded that MRI is the good imaging device for the evaluation of cerebral infarction.

Conflict of interest: Nil

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